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AN EXPERIMENTAL STUDY USING SEMI-CONCRETE AND ABSTRACT MATERIALS IN A PAIRED ASSOCIATIVE LEARNING TASK WITH HEARING-IMPAIRED AND HEARING CHILDREN

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AN EXPERIMENTAL STUDY USING SEMI-CONCRETE AND ABSTRACT MATERIALS IN A PAIRED ASSOCIATIVE LEARNING TASK WITH HEARING-IMPAIRED AND HEARING CHILDREN

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES--Continued

AN EXPERIMENTAL STUDY USING SEMI-CONCRETE AND ABSTRACT MATERIALS IN A PAIRED ASSOCIATIVE LEARNING TASK WITH HEARING-IMPAIRED AND HEARING CHILDREN

CHAPTER I

INTRODUCTION

Language is a complex system of symbols, and symbols are abstractions which stand for something. Words are language symbols just as numbers are mathematical symbols.[1]

Deafness is a language handicap. A child who has severely impaired hearing before he learns language does not usually learn language naturally but must be taught this most highly developed and complex art, which is most easily learned through hearing. Even for children who hear, the richness of the experiences which they have had will influence the richness of the language which they develop. For the child with a severe hearing loss the world which he experiences is never the same as it is to a person who has normal, undistorted hearing. Ostern asks, "What is silent laughter?"[2]

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[1]Nancy Wood, "Language in Personality Development," Volta Review, LXII (1960), 321.

[2]Bernice Ostern, "Panel Discussion," Volta Review, LXII (1960), 322.

Deaf people must rely on senses other than their hearing for an interpretation of the environment. They lack a sense for localization and distance which hearing gives and, therefore, their comprehension of space may be different or remain limited. They have no warning or, at least, less acute warning through hearing and are, therefore, startled more often by the unexpected.[3]

Myklebust said, "Deafness is a significant and consequential sensory deprivation" which causes the deaf person to experience the environment differently and, therefore, to behave differently. It is "difficult for him to use his intelligence in as broad and subtle and abstract a way."[4]

It has been widely held that a language limitation accompanying the lack of auditory stimulation makes the use of abstract concepts difficult for the deaf and causes them to be more dependent upon concrete experiences than hearing people. Pugh observed, however:

> Many deaf children seem to reason fairly well so long as they have pictures to guide them, but fail to make a satisfactory transition to verbal reasoning. For example; a child who is given a row of pictures illustrating the words; ball, car, boat, and girl, and told to cross out the one which does not belong in the group may succeed with the pictures and be unable to succeed when the words stand alone. This indicates

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[3]Edith Meyer, "Psychological and Emotional Problems of the Deaf Child," Am. Annals of the Deaf, 98 (1953), 472-477.

[4]Helmer R. Myklebust, "Towards a New Understanding of the Deaf Child," Am. Annals of the Deaf, 98 (1953), 345-359.

it is not concepts but symbols used to represent the concepts which are not understood.[5]

Some people have followed the thinking of Benjamin Whorf, who felt that all higher levels of thinking are dependent upon language and that the structure of language which one uses helps to shape his feelings about the environment. Doehring, however, stated that it is higher levels of verbal activity which are dependent upon language, but non-verbal abilities of language handicapped children could be developed normally in spite of a language deficiency. The language retardation of a child with limited hearing is due to a lack of verbal stimulation through hearing rather than to a lesion of the left hemisphere of the brain, but if a child who has no emotional disorder exhibits severe difficulties with non-verbal abilities, an organic impairment of the right hemisphere should be suspected.[6]

Factors Inhibiting to Learning

It is the philosophy of some educators that if the problem or handicap is deafness, and if the child can be taught early enough, in a favorable environment, with uninhibiting methods, he should be able to establish a language foundation upon which to build abstract concepts and this aspect of his handicap could be lessened if not alleviated.

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[5]Bessie Pugh, "Panel Discussion," Volta Review, LXII (1960), 335.

[6]Donald G. Doehring, "Panel Discussion," Volta Review, LXII (1960), 323.

Some of the limitations of the language learning of deaf children might be due to inhibiting educational practices rather than to something inherent in the deafness itself. Early systems of presenting language to the deaf followed step by step procedures with prearranged drills, extensive word lists to be mastered at each learning level, and pre-planned experiences to be worked through routinely. After one routine was finished the teacher knew which would follow. Many materials and methods of this type are in use today. A different concept of teaching language to the deaf was presented by Groht:

> True language cannot be taught by rote. It cannot be acquired by definition and mechanical drill. It cannot be divested of its social significance nor removed from its social setting. There must be reasons for using it and these must spring from the individual's deep need for making known his thoughts, ideas, needs, desires, hopes, imaginations, joys, and perplexities.[7]

This newer emphasis is harmonious with theories of learning upon which modern education bases its philosophy. Ragan presented some contrasting theories of learning:

> The mechanistic concept of learning . . . rests upon common assumptions. It assumes that wholes are built up from parts, that learning is an additive process like the adding of bricks to a wall, that the learner reacts as a collection of parts rather than as a unified whole, and that repetition and drill are sufficient to produce learning.[8]

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[7]Mildred Groht, Natural Language for the Deaf (Alexander Graham Bell Association, 1958), 1.

[8]W. B. Ragan, Modern Elementary Curriculum (New York: The Dryden Press, 1956), 44.

and the organismic concept:

> Learning is a growth process rather than an additive process; it is the result of insight, maturation, and differentiation rather than repetition; and it follows the pattern of growth of living organisms rather than that of inorganic bodies. The human embryo is at first an undifferentiated mass; the parts appear gradually through the process of maturation and differentiation. The same principle applies to the mental growth of the child; whole concepts appear first, and separate parts have meaning only because of their relationship to wholes.[9]

He summarizes the necessary elements for successful learning:

1. The child must want something. There must be a drive or a need to learn.

2. The child must notice something.

3. The child must do something.

4. The child must get something. Reward must follow response.[10]

Ragan also stated: "The real proof of the professional status of an elementary school lies in the development of a school program in harmony with the characteristics and needs of children."[11]

Heilman pointed out what pressure can do to children who are trying to learn to read. "Too much pressure or the wrong kind of pressure may result in non-learning."[12]

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[9] Ibid., 45.

[10] Ibid., 48.

[11] Ibid., 51.

[12] Arthur Heilman, Principles and Practices of Teaching Reading, (Charles E. Merrill Books, Inc., 1961), 4.

> Reading is a language function. It is the manipulation of symbolic materials. Psychologists and other observers of human behavior tell us that the symbolic process is sensitive to pressures of any kind. It is axiomatic that language is the most sensitive indicator of personal or emotional maladjustment. Yet in no area of learning in our schools is greater pressure brought to bear on the pupil than in the area of reading.[13]

It might be said that in no other area of learning for the deaf is more pressure brought to bear than in the area of learning language, through speech, lip-reading, and reading. At an age when hearing children are advancing to higher levels of reasoning because of experience and training, the hearing handicapped child may be still drilling on basic fundamentals of language. Perhaps basic traits of teachers of the deaf are acceptance and a relaxed attitude.

Goetzinger and Rousey studied the performance and achievement of deaf children and from the results of their testing inferred that expectations for the deaf were far below those for normally hearing children. They cited several possible reasons for the difference and suggested that studies be made upon the effects of lack of pre-school training, pupil load per teacher, techniques for developing language and abstract concepts, auditory training procedures, and therapy relating to emotional problems.[14]

After studying levels of aspiration of academically

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[13] Ibid.

[14] C. E. Goetzinger and C. L. Rousey, "Educational Advancement of Deaf Child," American Annals of the Deaf, 104 (1959), 221-231.

successful and unsuccessful children, Sears found an interesting interaction between success and aspiration and described an active and passive behavior as "participating behavior" and "spectator behavior."[15]

Rutledge studied the levels of aspiration of some deaf children and found that the deaf "tend to aspire to lower than normal achievement in tasks which involve their handicap but do not lower their goals when functioning does not call for use of the impaired faculty."[16]

Ragan mentioned many factors which cause maladjustment and inhibit learning in children and added that it is easy for teachers to rationalize about these non-learning children. He mentioned physical factors, poor health habits, mental immaturity, unsuitable curriculum, inhibiting educational policies, unwholesome family relations and community influences.[17]

Because such factors often cause discouragement to hearing handicapped children, it is important for those who work with them not only to understand the developmental needs of normal children, but also to strive for a better

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[15]Pauline S. Sears, "Levels of Aspiration in Academically Successful and Unsuccessful Children," Journal of Abnormal Social Psychology, 35 (1940), 498-536.

[16]Louis Rutledge, "Aspiration Levels of the Deaf Compared to Hearing," Journal of Speech and Hearing Disorders, 19 (1954), 375-380.

[17]W. B. Ragan, Teaching America's Children, (Holt, Rinehart and Winston, Inc., 1961), 79-80.

understanding of the special needs of children with limited hearing in order to try to alleviate inhibiting influences and help them to realize the best of their potential.

Needed Research

Much research needs to be done to further this understanding. Fouracer pointed out the scarcity of research concerning curriculum and learning problems of the hearing handicapped and asked for more detailed studies in areas of case finding, differential diagnosis, education, intelligence and personality. He said that Myklebust and Bautten had called for research in teaching methods, stature of students and graduates, curriculum, and administration.[18]

This present study was designed to examine one area of interest basic to this field which has many problems yet to be resolved. It sought to explore a question concerning the ability of children with limited hearing to remember abstract figures through associative learning, based on a statement by Pugh quoted earlier in this paper.[19]

Review of Literature

A favorite subject of early investigators concerned the intelligence of the deaf. In a recent study of the intelligence of the deaf, using separate standardizations of

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[18]Maurice H. Fouracer, "Physical Handicapping," Encyclopedia of Educational Research, (1960), 996.

[19]Pugh, loc. cit.

the Nebraska Test of Learning Aptitude, Hiskey found that on items where vocalizations aided immediate recall, hearing children had an advantage and were able to use their potential more efficiently. He doubted that the deaf could completely overcome the "loss of efficiency resulting from deafness and less facility with verbal abstractions," but felt that they were likely to equal the hearing on non-verbal functions and perhaps excel in visual perception.[20]

Much recent work has tested the ability of the deaf to understand abstract concepts.

Pellet, attempted to analyze thinking and its expression in the deaf child in a study which included a comparison of the thinking of the deaf from the non-language stage through adolescence, with that of hearing children, which he reviewed and summarized from the works of Nagy, Stumpf, Decroly, Dolacroix, Piaget, and others. For the normally hearing children he listed the following stages: 1st infancy, 0-3 years, motor stage; 2nd infancy, 3-7 years, perceptual stage; 3rd infancy, 7-12 years, speculative concrete; adolescence, 12-18 years, speculative abstract stage.

For the deaf children he traced similar stages: prelinguistic thinking, 0-7 years; verbal thinking, 7-13 years; conceptual (concrete) thinking, 13-15 years; logical

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[20]Marshall S. Hiskey, "A Study of the Intelligence of Deaf and Hard of Hearing Children (Through a Comparison of Performance on the Separate Standardizations of the Nebraska Test of Learning Aptitude)," American Annals of the Deaf, 101 (1956), 329-339.

abstraction, 15 years to adult.[21]

Oleron reviewed studies of the intelligence of the deaf and concluded that they were equal to hearing children in concrete mental functioning but deficient in abstract intelligence. Oleron administered the 1938 edition of Raven's Progressive Matrices to a total of 246 deaf children between the ages of 9 and 21 years of age and found that "the mental processes of the deaf are characterized by an especial concern for observed data" and this "becomes an obstacle when they are confronted with tests demanding a certain level of abstract thinking" which indicated "a stage of incomplete development, similar to an earlier stage found in normal children." He felt that deaf students could attain a conceptual level, "but with more difficulty than for normal students." He considered the field of abstraction to be important and felt that teachers should open the minds of the deaf pupil to "ideas and notions of the society in which he lives and teach him to use them." He stated:

> The sphere of abstract thought is by no means closed to the deaf. If the access to it is more difficult for him than for the hearing, it is no less true that progress in and choice of methods of education can reduce the difficulty.[22]

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[21]R. Pellet, "Des Premieres Perceptions du Concret a la Conception de l'Abstrait; Essai d'Analyse de la Pensée et son Expression Chez l'Enfant Sourd-muet." as reviewed by H. Myklebust in Psychological Abstracts, 2865 (1941), 311.

[22]P. Oleron, "A Study of Intelligence in the Deaf," American Annals of the Deaf, 95, (1950), 179-195.

Wright investigated abstract reasoning of deaf college students in a dissertation study. He felt that part functions of the organism were interrelated in such a way that disturbance of one affected the whole in such a way that there would be a "compensatory organismic shift to a lower level of functioning." He compared the performances of deaf and hearing college students on nine measures of abstract reasoning and concluded that a hearing loss does cause an organismic shift occasioning a lowering of abstract functioning.[23]

Larr studied twenty-five deaf children from each of two residential schools, a control group of normal children and another of mentally retarded children. He found no marked differences between the deaf children and the normal children using perceptual materials, but found that the deaf children were inferior in performance in concept formations. He also noted differences between the two groups of deaf children and therefore felt that it was inadvisable to equate children from one school with the deaf in general.[24]

Rosenstein studied the cognitive abilities of sixty deaf and sixty hearing children with a test battery which

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[23]Rogers Hornsby Wright, "The Abstract Reasoning of Deaf College Students," Dissertation Abstracts, 15 (1955) 1911.

[24]Alfred L. Larr, "Perceptual and Conceptual Abilities of Residential School Children," Volta Review, 889 (1959), 19-21.

included a perceptual discrimination task, a modified Wisconsin Card Sorting Task, and a concept attainment and usage task, all presented visually and non-verbally. He found no significant differences between deaf and hearing children in their ability to perceive, abstract, or generalize if the language used was within the capacity of the deaf children. He felt that in examinations where a conceptual deficit was observed the linguistic demands of the test were beyond the abilities of the deaf children.[25]

Recent studies have been concerned with the abilities of deaf children in ways which are not primarily language areas and have explored the possibilities that the deaf may differ from the hearing in ways other than deafness.

Four studies have dealt with visual responses of the deaf, two of which were concerned with visual memory, one with visual paired-associates, and one with visual pictorial thinking.

A study comparing the visual-pictorial thinking of the deaf to that of hearing children was done by Gozova by studying the ability to see part to whole relationships of objects such as pencil and match. He found that the younger deaf children were inferior to hearing children, but that with education, especially with mastering of fractions,

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[25]Joseph Rosenstein, "Cognitive Abilities of Deaf Children," Journal of Speech and Hearing Research, 3 (1960), 108-119.

differences tended to disappear.[26]

Blair used Knox cubes, Memory for Designs, object location and four memory tests. He found the deaf to be inferior to the hearing on memory span, but superior on the Knox cubes and Memory for Designs.[27]

Doehring compared the visual spatial memory of aphasic, deaf and hearing children on the ability to indicate the position of a spot of light which had been flashed briefly on a piece of paper. There were variations in the presentation of the light and the ways the responses were allowed to be made, the variation of duration of exposure of the light flash, variation of time elapsing before a response was allowed, and interference with the subject's vision after the flash and before the response. The errors of the hearing group were smaller than those of the deaf subjects and the deaf group had a smaller number than the aphasic. However, there was no significant difference in the response of the deaf group and that of the hearing so that Doehring concluded that deafness does not seriously impair visual perceptual abilities.[28]

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[26]A. P. Gozova, "K Voprous o Naglyadno-obraznom Myshleni Glukhoemykh Ucha Shchykhsya," (Doll. Akad Pedog. Nauk RSFSR, 1960), II, 125-128. Reviewed by A Cuk, Psychological Abstracts, 36 (Feb. 1962), 157.

[27]Francis X. Blair, "A Study of the Visual Memory of Deaf and Hearing Children," American Annals of the Deaf, 102 (1957), 254-263.

[28]Donald G. Doehring, "Visual Spatial Memory in Aphasic Children," Journal of Speech and Hearing Research, 3 (1960), 138-149.

Furth devised a paired-associates test for memory of simple color using four colors: red, orange, yellow and blue, and two toy animals; a cat and a mouse. He used forty cards, ten of each color, with a large letter "M" on the back of each card colored orange or yellow and a large letter "C" on the back of each card colored blue or red. The child was taught to associate the letter "M" with the mouse and the letter "C" with the cat. After learning this task the unlettered colored side was shown and the child was to respond with the associated animal. The deaf children from seven to ten years of age were able to equal the performance of hearing children, but the 11-12 group was inferior to the hearing group of that age.

Furth suggested that the deaf children have the same basic abilities as shown by the fact that the younger group could equal the hearing children but that with training and experience in life and school the hearing children learn habits and attitudes which give them an advantage. The deaf children spend so much time in school learning the basic fundamentals of language that little time is given to developing their cognitive reasoning. Furth observed that a recent trend in scientific evidence showed that the deaf are not as different as they had formerly been thought to be.[29]

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[29]Hans G. Furth, "Visual Paired-Associates Task with Deaf and Hearing Children," Journal of Speech and Hearing Research, 4 (1961), 172-177.

CHAPTER II

STATEMENT OF THE PROBLEM

The purpose of this study was to investigate the differences, if any, in the rate of learning and in the number of errors made in reaching the criterion of learning of children with limited hearing and of a control group of hearing children when confronted with abstract and semi-concrete materials in associative learning tasks. The abstract figures were chosen because they were meaningless to the Subjects and were without application to particular objects, but when assigned meaning they become symbols as do letters of the alphabet. The semi-concrete figures were pictures with specific application to particular objects.

A question of importance in the teaching of children concerns their ability to learn abstract figures. Do hearing handicapped children have greater difficulty with abstract figures than with semi-concrete figures, or require more trials in mastering them than hearing children, and do they make more errors?

In order to determine the differences, if any, in the rates of learning and the number of errors made by children with limited hearing and by hearing children under the

various conditions the following null hypotheses were tested:

1. There is no statistically significant difference in the number of trials required to meet the criterion of learning in a paired associative learning task utilizing semi-concrete material and in a paired associative learning task utilizing abstract material of children with limited hearing.

2. There is no statistically significant difference in the number of trials required to meet the criterion of learning in a paired associative learning task utilizing semi-concrete material and in a paired associative learning task utilizing abstract material of a control group of hearing children.

3. There is no statistically significant difference in the number of trials required to meet the criterion of learning in a paired associative learning task utilizing semi-concrete material of children with limited hearing and of a control group of hearing children.

4. There is no statistically significant difference in the number of trials required to meet the criterion of learning in a paired associative learning task utilizing abstract material of children with limited hearing and of a control group of hearing children.

5. There is no statistically significant difference in the number of errors in meeting the criterion of learning in a paired associative learning task utilizing semi-concrete

material and in an associative learning task utilizing abstract material of children with limited hearing.

6. There is no statistically significant difference in the number of errors in meeting the criterion of learning in a paired associative learning task utilizing semi-concrete material and in an associative learning task utilizing abstract material of a control group of hearing children.

7. There is no statistically significant difference in the number of errors in meeting the criterion of learning in a paired associative learning task utilizing semi-concrete material of children with limited hearing and of a control group of hearing children.

8. There is no statistically significant difference in the number of errors in meeting the criterion of learning in a paired associative learning task utilizing abstract material of children with limited hearing and of a control group of hearing children.

9. There is no statistically significant difference in the ratio of trials used in meeting the criterion of learning semi-concrete materials to the trials used in meeting the criterion of learning abstract materials, of children with limited hearing and a control group of hearing children.

CHAPTER III

PROCEDURE OF THE STUDY

The Pilot Study

Subjects

The subjects in the pilot study consisted of thirty-three children with no reported school failure, behavioral problems or gross abnormal behavior. None of the children were known to have hearing impairments, visual disabilities or speech defects. They ranged from five to fifteen years of age. All of the subjects tested in the normal range or above on the Goodenough Draw-A-Man Intelligence Test.

Materials

The learning materials consisted of two booklets of semi-concrete and two booklets of abstract materials. Each booklet consisted of sixteen six inch by four inch white cardboard cards bound by a plastic spiral binder. Booklet IC contained thirteen cards on which there were one pair of outline drawings, a blank card between the sample card and stimuli cards and a blank card serving as the back and front of the booklet. Booklet 2C contained thirteen cards on which appeared the first picture of the pair shown in book-

let IC. The first card was used as a sample card for instructional purposes, the remaining twelve constituted the measuring device. Booklet 2C was constructed with the same size, shape, and number and arrangement of cards as booklet IC. The two booklets containing the abstract materials were constructed the same as those for the semi-concrete items with the exception of the nature of the drawings.

The pictures for the semi-concrete items contained in booklet IC and 2C were simple outline drawings of common objects; they were not obviously affect arousing, and commonly associated items were not paired.

The items utilized for abstract materials in booklet IA and 2A were meaningless lines of different configuration. They were Gregg shorthand symbols with some modifications to avoid similarities. Items that had similar lines were not paired.

The response cards consisted of ten eleven inch by twelve and one-half inch white cardboard cards for each type of material. All of the response items were drawn in random order on each card in order to eliminate the possibility of serial learning from the response cards.

The Examiner utilized individual record sheets for each Subject which contained: the name of the Subject; the Subject's age; the Subject's I.Q.; the type of stimuli presented; the record of the responses made by the Subject; the total number of errors made by the Subject; and the

total number of trials required to reach the criterion of learning.

The criterion of learning was defined as correctly identifying all twelve items.

A stop watch was used in timing the presentation of the stimuli, the timing of the intertrial period, and the timing of the response period.

The Procedure

Each subject was tested individually in a location that was comfortable, well lighted, well ventilated and was free from interruptions.

The following instructions were given to each Subject:

> Here are a number of cards. Each card has two pictures on it. Look at both pictures on each card carefully. (The Examiner showed the Subject either IC or IA sample stimuli.) Then I will show you a set of cards like these. (The Examiner showed the Subject the sample card with the corresponding first picture of the stimulus pair on either 2C or 2A.) You are to point to the picture on the response card that was with this first picture. You are to point to the drawing on the response card that is missing. (The Examiner showed the Subject the card containing the sample picture included with eleven other response items.) You are supposed to remember which two drawings go together. Point to the drawing that goes with this one. (If the Subject correctly identifies the sample stimuli the test items are then presented. If the Subject does not correctly identify the sample stimuli he is shown the Sample stimuli on IC or IA again until he is able to correctly point to the missing drawing before the test is continued.)

The twelve paired pictures were presented to each subject visually with three seconds of exposure time for

each picture. Then, the first pictures of each pair were presented in booklet two at the rate of one every five seconds. The order of presentation of semi-concrete or abstract materials to the subjects was divided to control any confounding effects that might have occurred.

The criterion of learning consisted of correctly identifying all twelve items. Each subject was given both the semi-concrete and abstract items until a criterion of learning was reached. The Subject was given no indication of the correctness of responses. The Examiner recorded each response made by each Subject. A failure to respond in the time limit was reported as a failure. If any of the responses were incorrect during a trial the Subject was given another trial. Intertrial intervals were ten seconds in duration. During the intertrial interval, the Examiner said:

> Now we shall look at the pictures again. Try to remember what two pictures go together. Point to the picture that is missing.

A different response card was used for each trial for ten trials. If the Subject did not reach a criterion of learning in ten trials the ten response cards were utilized again.

If the subject became restless or questioned the Examiner about the results of the test, the Examiner said:

> We shall keep looking at the pairs of pictures until you remember all of them.

The Obtained Data

The following data were obtained for each child participating in the pilot study: Name, age, response to each test item, total number of errors made by each subject, and the total number of trials necessary to reach a criterion of learning.

The results of the pilot study showed that the materials were usable for the study. The directions were easily understood; the response cards provided a suitable means of response; no associated pairs were learned first by any large number of children, but rather a wide range of differences was noted in individual patterns of response. The materials were interesting to the children, the task challenging, and the test held the enthusiasm of most of the children through the testing session.

Suitability of the Test

The test seemed particularly suitable for use with hearing handicapped children since the directions could be given in pantomime and the responses were made by pointing to the correct symbol. The associative thinking task was also a suitable choice.

Russell cited a recent revival of interest in associative thinking, and pointed out the role of associative thinking in learning to spell, read, and acquire number facts, and in word recognition, as well as in much of the

child's thinking.[30]

The hearing handicapped child is faced with associative learning from the time he first learns that objects have names and these names are associated through lip reading. The child must eventually learn that symbols go together to make a word and that the word stands for the name of the object. The deaf child must learn the concept of number, the symbol which stands for the number, the lip movements which denote it, and the objects which collectively represent that number. Associative learning is, in fact, a learning experience for both hearing and hearing handicapped children.

The Experimental Study

Subjects

The hearing handicapped subjects used in this study were eighteen pupils of the Oklahoma School for the Deaf in Sulphur, Oklahoma, two of whom lived in Sulphur and attended the school as day school pupils, while the others were residential pupils. Twelve of them had had hearing losses since birth and the other six had acquired their hearing losses at from eleven to twenty-four months. They had first entered school at ages of from four years to eleven years with thirteen of the subjects entering at the ages of five and six.

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[30]David H. Russell, "Higher Mental Processes," Encyclopedia of Educational Research, (1960), 648-649.

Two entered at the age of eight years and one each entered at the ages of four years, ten years and eleven years. These children all communicated in signs, did not respond to the spoken communication of the Examiner, and were not alert to lip movements. They ranged in chronological age from 107 to 153 months, with the average being 134 months.

A mental age was obtained from the Ontario School Ability Examination[31] which was developed for the testing of deaf children. The children were found to range in mental age from 105 months to 149 months with the average being 129 months. This test and the experimental materials were administered in a quiet, pleasant room, away from the activity of the other school rooms.

Children in the control group were students at Ray F. Fitzmorris School in Arvada, Colorado, which is a part of the Jefferson County School District Number R-1. Arvada is a middle class community and the children were selected for this study on the basis of age and of their performance on the Ontario School Ability Examination. They ranged in chronological age from 105 months to 151 months with the average being 132 months. The mental ages ranged from 102 months to 146 months with the average being 129 months. These children had no record of school failure and were considered by their teachers to be normal in their

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[31]Harry Amoss, Ontario School Ability Examination, (Toronto, The Ryerson Press, 1939).

sensory perceptions, without visual disabilities, hearing impairments and speech defects.

Test Procedure

As in the pilot study, each response to the abstract and semi-concrete materials was recorded. The criterion of learning was satisfied when the child had responded correctly to all of the twelve paired associates of each type of material. The number of trials required for mastery and the number of errors were recorded and totaled for each child for each type of material. The test was administered in the manner described in the pilot study, with the Examiner giving spoken instructions to the hearing handicapped group in order to preserve a uniform situation and a friendly informal atmosphere. However, these children understood the directions by motion and gesture. Although they did not understand the spoken language, they had no difficulty understanding and complying with the procedure of the test, because the materials are somewhat self-explanatory when presented in this manner. The test for mental maturity and the experimental test materials were administered individually to each child on different days.

CHAPTER IV

THE RESULTS

The purpose of the investigation was to determine if there was a statistically significant difference between the ability of hearing handicapped subjects to learn abstract symbols and their ability to learn concrete symbols; and to determine if there was a statistically significant difference between the ability of the hearing handicapped subjects and of hearing children to learn these materials. Also it sought to determine if there was a statistically significant difference in the number of errors made by these groups in reaching the criterion of learning. The level of statistical significance for this study was set at .05.

The statistical technique suitable for the treatment of the data was a nonparametric statistic, the Kolmogorov-Smirnov Two Sample Test.[32] The first hypothesis to be tested concerned the difference if any in the number of trials required for the hearing handicapped child to learn semi-concrete and abstract materials. The number of trials

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[32]Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York, McGraw-Hill Book Company, 1956), 127-136.

required for each type of material by the hearing handicapped children is given in Table 1.

TABLE 1

NUMBER OF TRIALS REQUIRED BY THE HEARING IMPAIRED CHILDREN FOR LEARNING SEMI-CONCRETE AND ABSTRACT MATERIALS

Number of Trials	Number of Children	
	Semi-Concrete	Abstract
1-3	6	0
4-6	7	0
7-9	4	0
10-12	1	2
13-15	0	3
16-18	0	4
19-21	0	5
22-24	0	1
25-27	0	1
28-30	0	2

To apply the Kolmogorov-Smirnov test these data were recast into two cumulative frequency distributions as shown in Table 2.

The differences between the two samples at various intervals were found by simple subtraction. For a one-tailed test with N=18, a difference of 10 is significant at the level of .01. The largest difference, 17, favored the semi-concrete group and was found at the 7-9 trial category. The

H_0 was rejected and it was observed that these hearing handicapped children used significantly more trials in learning abstract than in learning semi-concrete materials.

TABLE 2

DATA IN TABLE 1 CAST FOR KOLMOGOROV-SMIRNOV TEST

	Number of Trials									
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30
S_{18}(S-C)	6/18	13/18	17/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18
A_{18}(A)	0/18	0/18	0/18	2/18	5/18	9/18	14/18	15/18	16/18	18/18

The next hypothesis to be tested concerned the difference if any in the number of trials required by the control group of hearing children to learn the semi-concrete and abstract materials. These data are given in Table 3.

To apply the Kolmogorov-Smirnov test these data were recast into two cumulative frequency distributions as shown in Table 4.

The largest difference as found by simple subtraction was in the 10-12 trial category and the difference was 13, favoring the semi-concrete materials. Since 10 is significant at the level of a=.01, it was noted that the hearing children also used a significantly greater number of trials learning the abstract materials than in learning the semi-concrete materials.

TABLE 3

NUMBER OF TRIALS REQUIRED BY THE CONTROL GROUP FOR LEARNING SEMI-CONCRETE AND ABSTRACT MATERIALS

Number of Trials	Number of Children	
	Semi-Concrete	Abstract
1-3	7	0
4-6	6	0
7-9	3	4
10-12	1	4
13-15	1	6
16-18	0	2
19-21	0	1
22-24	0	1

TABLE 4

DATA IN TABLE 3 CAST FOR KOLMOGOROV-SMIRNOV TEST

	Number of Trials							
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24
$S_{18}(S-C)$	$\frac{7}{18}$	$\frac{13}{18}$	$\frac{16}{18}$	$\frac{17}{18}$	$\frac{18}{18}$	$\frac{18}{18}$	$\frac{18}{18}$	$\frac{18}{18}$
$S_{18}(A)$	$\frac{0}{18}$	$\frac{0}{18}$	$\frac{4}{18}$	$\frac{8}{18}$	$\frac{14}{18}$	$\frac{16}{18}$	$\frac{17}{18}$	$\frac{18}{18}$

The third hypothesis to be tested concerned the number of trials required to meet the criterion of learning the semi-concrete materials by the hearing handicapped and the control group of hearing children. To test for difference the data were arranged in Table 5.

TABLE 5

NUMBER OF TRIALS REQUIRED BY THE CONTROL GROUP AND BY HEARING IMPAIRED CHILDREN IN LEARNING SEMI-CONCRETE MATERIALS

	Number of Children	
Number of Trials	Control Group	Hearing Impaired
1-3	7	6
4-6	6	7
7-9	3	4
10-12	1	1
13-15	1	0

These data were recast into two cumulative frequency distributions as shown in Table 6 in order to apply the Kolmogorov-Smirnov test.

TABLE 6

DATA IN TABLE 5 CAST FOR KOLMOGOROV-SMIRNOV TEST

	Number of Trials				
	1-3	4-6	7-9	10-12	13-15
S_{18} (Control)	$\frac{7}{18}$	$\frac{13}{18}$	$\frac{16}{18}$	$\frac{17}{18}$	$\frac{18}{18}$
S_{18} (Hearing Impaired)	$\frac{6}{18}$	$\frac{13}{18}$	$\frac{17}{18}$	$\frac{18}{18}$	$\frac{18}{18}$

There was such great similarity in the results of these two samples that there was no significant difference and it was observed that the hearing handicapped and the control group learned the semi-concrete material with equal facility with respect to the number of trials used.

The fourth hypothesis to be tested concerned the ability of the hearing handicapped children and of the control group of hearing children to learn the abstract materials. To test for difference the data were arranged in Table 7.

TABLE 7

NUMBER OF TRIALS REQUIRED BY THE CONTROL GROUP AND THE HEARING IMPAIRED CHILDREN FOR LEARNING THE ABSTRACT MATERIALS

	Number of Children	
Number of Trials	Control Group	Hearing Impaired
1-3	0	0
4-6	0	0
7-9	4	0
10-12	4	2
13-15	6	3
16-18	2	4
19-21	1	5
22-24	1	1
25-27	0	1
28-30	0	2

To apply the Kolmogorov-Smirnov test these data were recast into two cumulative frequency distributions as shown in Table 8.

At the 13-15 trial category there was a difference of 9 between these two groups, favoring the control group.

Since 8 is significant at the level of a=.05 it was noted that the control group of hearing children used a significantly fewer number of trials in learning the abstract materials. It should also be noted, however, that there was a wide variation in both groups and that there was also a wide area of overlapping in the scores of the two groups.

TABLE 8

DATA IN TABLE 7 CAST FOR KOLMOGOROV-SMIROV TEST

	Number of Trials									
	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27	28-30
S_{18}(C)	0/18	0/18	4/18	8/18	14/18	16/18	17/18	18/18	18/18	18/18
S_{18}(H I)	0/18	0/18	0/18	2/18	5/18	9/18	14/18	15/18	16/18	18/18

The fifth hypothesis to be tested concerned the difference if any, in the number of errors made while learning the semi-concrete materials and in learning the abstract materials by the children with limited hearing. The data for testing this hypothesis is shown in Table 9.

These data were recast into two cumulative frequency distributions as shown in Table 10.

A difference of 11 appears at the first category of 0 to 14 errors. At the next category of 15-29 errors is a difference of 13, and 13 is also the difference shown in the

next category of 30-44 errors. Both favor the semi-concrete materials. All of these are above the level of significance at the level of .01 which for an N=18 is 10.

TABLE 9

ERRORS MADE BY HEARING IMPAIRED CHILDREN IN SEMI-CONCRETE AND ABSTRACT MATERIALS

	Number of Children	
Number of Errors	Semi-Concrete	Abstract
0-14	11	0
15-29	5	3
30-44	1	1
45-59	0	1
60-74	1	2
75-89	0	3
90-104	0	2
105-119	0	1
120-134	0	2
135-149	0	2
150-164	0	0
165-179	0	0
180-194	0	0
195-209	0	1

One subject made no errors in the semi-concrete material and another subject made sixty errors learning the same material. Almost two-thirds of the subjects made fourteen or fewer errors on this material. All of the sub-

jects made fifteen or more errors in learning the abstract materials and one subject made 207 errors, which was seventy-two more errors than were made by any other subject. While it was observed that the hearing handicapped children made significantly more errors in learning the abstract materials than in learning the concrete materials, it was observed that for some of them it was much more difficult than it was for others.

TABLE 10

DATA FROM TABLE 9 CAST FOR KOLMOGOROV-SMIROV TEST

	Number of Errors													
	0 to 14	15 to 29	30 to 44	45 to 59	60 to 74	75 to 89	90 to 104	105 to 119	120 to 134	135 to 149	150 to 164	165 to 179	180 to 194	195 to 209
$S_{18}(S-C)$	11/18	16/18	17/18	17/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18
$S_{18}(A)$	0/18	3/18	4/18	5/18	7/18	10/18	12/18	14/18	16/18	17/18	17/18	17/18	17/18	18/18

The sixth hypothesis to be tested concerned the difference, if any, in the number of errors made by the control group in learning the semi-concrete materials and in learning the abstract materials. The data concerning these errors are listed in Table 11. These data were recast into two cumulative frequency distributions in order to apply the Kolmogorov-Smirnov test as shown in Table 12.

TABLE 11

ERRORS MADE BY CONTROL GROUP OF HEARING CHILDREN ON SEMI-CONCRETE AND ABSTRACT MATERIALS

Number of Errors	Number of Children	
	Semi-Concrete	Abstract
0-14	13	1
15-29	2	1
30-44	2	5
45-59	1	4
60-74	0	3
75-89	0	3
90-104	0	1

TABLE 12

DATA IN TABLE 11 CAST FOR KOLMOGOROV-SMIRNOV TEST

	Number of Errors						
	0-14	15-29	30-44	45-59	60-74	75-89	90-104
S_{18}(S-C)	$\frac{13}{18}$	$\frac{15}{18}$	$\frac{17}{18}$	$\frac{18}{18}$	$\frac{18}{18}$	$\frac{18}{18}$	$\frac{18}{18}$
S_{18}(Abstract)	$\frac{1}{18}$	$\frac{2}{18}$	$\frac{7}{18}$	$\frac{11}{18}$	$\frac{14}{18}$	$\frac{17}{18}$	$\frac{18}{18}$

In the first category of 0-14 errors the difference was 12. In the second category of 15-29 the difference was 13, favoring the semi-concrete materials. Both of these are above the level of significance at the level of .01. Therefore, the control group made significantly more errors learning the abstract materials. Errors for the control

group in learning the semi-concrete material varied from one to fifty-four. For the abstract material the errors varied from eleven to ninety-one.

The seventh hypothesis to be tested concerned the difference, if any, in the number of errors made by the hearing handicapped children and by the control group in learning the semi-concrete material. The data for this test were arranged in Table 13, and recast into two cumulative frequency distributions in Table 14 in order to apply the Kolmogorov-Smirnov test.

TABLE 13

ERRORS MADE BY HEARING IMPAIRED CHILDREN AND BY THE CONTROL GROUP IN LEARNING THE SEMI-CONCRETE MATERIAL

	Number of Children	
Number of Errors	Control Group	Hearing Impaired
0-14	13	11
15-29	2	5
30-44	2	1
45-59	1	0
60-74	0	1

There was no significant difference in the various error categories between the hearing handicapped and the control group. The hearing handicapped children had the greater variation of scores since the number of errors made by them varied from 0 to sixty and for the control group

the variation was from one to fifty-four. However, the error pattern was quite similar for the two groups.

TABLE 14

DATA FROM TABLE 13 CAST FOR KOLMOGOROV-SMIRNOV TEST

	Number of Errors				
	0-14	15-29	30-44	45-59	60-74
S_{18}(Control Group)	$\frac{13}{18}$	$\frac{15}{18}$	$\frac{17}{18}$	$\frac{18}{18}$	$\frac{18}{18}$
S_{18}(Hearing Impaired)	$\frac{11}{18}$	$\frac{16}{18}$	$\frac{17}{18}$	$\frac{17}{18}$	$\frac{18}{18}$

The eighth hypothesis to be tested concerned the difference, if any, between the errors made by the hearing handicapped children and by the control group of hearing children in learning the abstract material. The material for testing this hypothesis was arranged in Table 15. The data were recast into two cumulative frequency distributions in order to apply the Kolmogorov-Smirnov test and were shown in Table 16.

The largest difference of seven was demonstrated at two categories, 60 to 74 and 75 to 89 errors. Since there must be a difference of eight in order to show significance at a=.05, it was noted that there was a difference, but not a significant difference in the number of errors made by the hearing handicapped children and the control group. It was noted, however, that there was a much wider variation in the

range of errors made by the hearing handicapped group than by the control group.

TABLE 15

ERRORS MADE BY THE HEARING IMPAIRED CHILDREN AND BY THE CONTROL GROUP IN LEARNING THE ABSTRACT MATERIAL

Number of Errors	Number of Children	
	Control Group	Hearing Impaired
0-14	1	0
15-29	1	3
30-44	5	1
45-59	4	1
60-74	3	2
75-89	3	3
90-104	1	2
105-119	0	1
120-134	0	2
135-149	0	2
150-164	0	0
165-179	0	0
180-194	0	0
195-209	0	1

The last hypothesis to be tested concerned the difference, if any, between the ratios of the trials in learning the semi-concrete materials to the trials in learning the abstract materials by the hearing impaired children and

the control group of hearing children. These ratios were found by dividing the number of trials used in learning the semi-concrete materials by the number of trials used in learning the abstract materials of each subject and multiplying the answers by 100. The results were compared by means of the Kolomogorov-Smirnov Two Sample Test and the data are shown in Table 17.

TABLE 16

DATA FROM TABLE 15 CAST FOR KOLMOGOROV-SMIRNOV TEST

	Number of Errors													
	0 to 14	15 to 29	30 to 44	45 to 59	60 to 74	75 to 89	90 to 104	105 to 119	120 to 134	135 to 149	150 to 164	165 to 179	180 to 194	195 to 209
S_{18}(C)	1/18	2/18	7/18	11/18	14/18	17/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18	18/18
S_{18}(H I)	0/18	3/18	4/18	5/18	7/18	10/18	12/18	13/18	15/18	17/18	17/18	17/18	17/18	18/18

This comparison was made because, although the hearing handicapped children used significantly more trials in learning the abstract material than did the control group, it was still possible that the relative difference between the number of trials they used to learn the abstract and semi-concrete materials would not be significant. For example, one child might use three trials in learning the semi-concrete materials and twelve trials in learning the abstract materials while another child might use six and

twenty-four trials in learning the same materials. The ratios would be the same, that is 25, showing relatively no difference between the abilities of the children to learn abstract materials and to learn semi-concrete materials.

TABLE 17

RATIOS OF TRIALS IN LEARNING SEMI-CONCRETE MATERIALS TO TRIALS IN LEARNING ABSTRACT MATERIALS BY HEARING IMPAIRED CHILDREN AND THE CONTROL GROUP OF HEARING CHILDREN

Ratios	Number of Children	
	Control	Hearing Impaired
0-15	0	6
16-30	9	2
31-45	4	9
46-60	1	0
61-75	1	1
76-90	2	0
91-105	0	0
105-120	1	0

These data were recast into two cumulative frequency distributions as shown in Table 18.

Since one child in the control group used fewer trials in learning the abstract material than in learning the semi-concrete material there is one ratio which is larger than 100.

A difference of 6 was found at the first category of 0 to 15. To be significant at the .05 level, the differ-

ence must be 8. The control group of hearing children used a relatively closer number of trials to learn the two types of materials than did the hearing handicapped group, but not significantly so.

TABLE 18

DATA FROM TABLE 17 CAST FOR KOLMOGOROV-SMIRNOV TEST

	Ratios of Trials for Semi-Concrete to Trials for Abstract							
	0 to 15	16 to 30	31 to 45	46 to 60	61 to 75	76 to 90	91 to 105	106 to 120
S_{18}(Control)	$\frac{0}{18}$	$\frac{9}{18}$	$\frac{13}{18}$	$\frac{14}{18}$	$\frac{15}{18}$	$\frac{17}{18}$	$\frac{17}{18}$	$\frac{18}{18}$
S_{18}(Hearing Impaired)	$\frac{6}{18}$	$\frac{8}{18}$	$\frac{17}{18}$	$\frac{17}{18}$	$\frac{17}{18}$	$\frac{18}{18}$	$\frac{18}{18}$	$\frac{18}{18}$

Summary of Results

It was found that the hearing handicapped children and the control group of hearing children both had significantly more difficulty (at the level of .01) with the abstract material than with the semi-concrete material both in regard to the number of trials it took to reach the criteria of learning, and in regard to the number of errors made. It was also found that the hearing handicapped children took significantly more trials to learn the abstract material (at the level of .05) than did the control group, but that while they used more errors, the difference in the

number of errors made by the two groups was just below the level of significance. A larger number of errors was made by the children on the first trials and as the material became more familiar they made fewer errors. Therefore, a child who consumed more trials might average fewer errors per trial. The number of trials used by both groups in reaching the criterion of learning of the semi-concrete material and in the number of errors made in achieving this goal and pattern of spread within each group was so similar as to show little if any difference, and certainly not at any significant level.

The ratios of the number of trials used in learning the semi-concrete materials to the number of trials used in learning the abstract materials by the hearing handicapped children and the control group of hearing children was compared and a difference was found showing that the control group was relatively closer in the ratio of trials used than was the hearing handicapped group, but the difference was not significant.

CHAPTER V

CONCLUSIONS AND SUMMARY

Many children with severe hearing handicaps fail to keep academic pace with hearing children and remain limited in their language ability. Since ability to learn abstract figures is intimately associated with language and reading abilities and with academic progress, this study was devised to test the ability of hearing handicapped children to learn abstract figures. The abstract figures were twelve pairs of shorthand symbols which were used as an associative learning study.

As a comparison to the performance of the hearing handicapped children in learning abstract symbols, their performance in learning semi-concrete material was also observed. Twelve pairs of pictures which were simple outline drawings of familiar objects comprised the semi-concrete material. The criteria of learning these materials was reached when all twelve pairs of each type of material were matched correctly. The number of trials used and the number of errors made in achieving this goal were recorded.

A control group of hearing children was given the same materials and their performance was compared with that

of hearing handicapped children. The control group was selected on the basis of age, and performance on the Ontario School Ability Examination in order to match the hearing handicapped group in regard to mental age. The hearing impaired group consisted of 18 pupils of the Oklahoma School for the Deaf at Sulphur, Oklahoma, who ranged in age from 107 months to 153 months with an average being 134 months. Their mental ages ranged from 105 months to 149 months with an average of 129 months. The control group of eighteen hearing children ranged in age from 105 months to 151 months with an average of 132 months. Their mental ages were 102 months to 146 months with an average of 129 months.

Nine null hypotheses were formulated and tested and some significant differences were noted as well as some similarities. The first hypothesis was rejected and it was noted that there was a significantly greater number of trials used by the hearing handicapped children in learning the abstract material than in learning the semi-concrete. The second similar hypothesis was also rejected when it was noted that the control group also used a significantly greater number of trials to learn the abstract material.

The third hypothesis was sustained and it was observed that there was great similarity in the number of trials and in the pattern of spread of the trials between the hearing handicapped children and the control group in learning the semi-concrete material.

However, the fourth hypothesis was rejected and it was noted that the hearing handicapped children used significantly more trials in learning the abstract material than did the hearing children.

The fifth hypothesis was rejected when it was observed that the hearing handicapped children made significantly more errors in learning the abstract materials than in learning the semi-concrete materials. The control group of hearing children also made significantly more errors in learning the abstract material than in learning the semi-concrete material so that it was necessary to reject the sixth hypothesis.

However no difference was noted in the number of errors which the hearing handicapped children and the control group used in learning the semi-concrete materials so the seventh hypothesis was sustained. There was a difference in the number of errors used by the hearing handicapped children and the control group of hearing children in learning the abstract material but the difference was just below the level of significance at the .05 level, so that the eighth hypothesis was sustained.

The last hypothesis was also sustained, because, while the control group had a closer ratio of trials of the semi-concrete to the abstract, the difference between the two groups was not significant.

While these differences were noted in favor of the

control group it must be pointed out that the hearing handicapped children were residential school pupils who had begun their school careers at four to eleven years with two-thirds of the group entering at the ages of five and six. These children communicated using signs. These factors might in themselves have bearing on the ability of these children to use abstractions, or they might have more direct bearing on the emotional stability of the children and thereby affect their ability to use abstractions.

Earlier in the study the importance of emotional stability in learning to use abstractions was pointed out. Many factors were mentioned which cause discouragement to academic progress for both hearing and hearing handicapped children.

Many studies were cited which sought to explore differences between hearing and hearing handicapped children. Hiskey felt that the deaf experienced a loss of efficiency "resulting from deafness and less facility with verbal abstractions." Pellet listed the stages of thinking and expression for hearing children and similar stages for deaf children, but with slower development. Oleron felt that the deaf attain a conceptual level of thinking, but with greater difficulty than for normal children. Wright felt that deafness caused an organismic shift to a lower level of functioning. Larr found no difference between deaf and hearing children using perceptual materials but found that the deaf

children were inferior in performance in concept formations. Rosenstein found no difference in the ability of the deaf children to perceive, abstract, or generalize if the language used was within the capacity of the deaf children.

Other studies dealing with visual responses, visual memory, visual paired-associates, and visual pictorial thinking found the deaf to be similar in their abilities to normal children. Furth observed that recent evidence showed that the deaf are not as different as they had formerly been thought to be.

In his study Larr found differences between the children from two schools for the deaf and said, therefore, that it was not wise to equate two groups of deaf children. The present study should be read with this in mind because there were factors which need to be tested further before generalizations could be made concerning the deaf in general.

Further testing with these materials might be fruitful using different samples of children with limited hearing in order to ascertain the effects of starting to school at an early age; attendance in day school classes; and using spoken English for communication.

Doehring was cited early in this paper as suggesting that if a child has no emotional disorder and exhibits severe difficulties with non-verbal abilities, an organic impairment of the right hemisphere should be suspected.

Fruitful exploration with these materials might be done in the field of brain damage with both hearing and hearing handicapped subjects.

In summary it can be said that the hearing handicapped children used significantly more trials and made more errors in learning the abstract materials than in learning the semi-concrete materials, as did the control group of hearing children. But it was also true that the hearing handicapped children used significantly more trials than the hearing children did in learning the abstract materials, though they performed quite similarly in learning the semi-concrete materials.

There was a difference, but not a significant difference, in the ratio of trials between the semi-concrete and abstract materials, with the control group having a closer ratio. This does not mean that it is the deafness itself which causes the greater difficulty, however. Therefore, other studies should be carried out in different situations to see if these results are typical of deaf children in general, or if there are other extenuating factors.

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APPENDIX I

INDIVIDUAL RECORD SHEET
(abstract)

Name _____ Age _____

I. Q. _____ Teacher _____

Stimulus	Response	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
ك	(ا)																						
ب	(ب)																						
ي	(ت)																						
ا	(ث)																						
ز	(ج)																						
س	(ح)																						
ه	(خ)																						
ن	(د)																						
ل	(ذ)																						
ع	(ر)																						
م	(ز)																						
ee	(س)																						

APPENDIX II

INDIVIDUAL RECORD SHEET
(semi-concrete)

Name _____ Age _____

I. Q. _____ Teacher _____

Pairs	Number of trials																				
Stimulus Response	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
saw (pet)																						
key (baseball)																						
cup (feet)																						
hat (book)																						
bowl (tree)																						
broom (box)																						
bread (skate)																						
pig (chair)																						
lamp (coat)																						
knife (phone)																						
shoe (bird)																						
pitcher(umbrella)																						