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The visual-auditory integrative ability of 12 language delayed children with nonspecific etiologies was compared with that of 12 normal children matched for age, sex, and IQ. A battery of tests measured auditory-visual integrative ability, visual motor ability, and perception of frequency distorted speech. Significant differences were found between the two groups in their visual-auditory integrative ability and the perception of frequency distorted speech. There was no difference between the two groups in visual motor integrative ability. Inasmuch as the two groups were significantly different for the auditory perceptual task it was difficult to determine whether the differences which exist between the two groups in the area of auditory-visual integrative skills were due to poor integration between these two modalities or due merely to the auditory component. (Author/JD)

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SUMMARY

Twelve language delayed children with non-specific etiologies were matched with children having normal language development for age, sex and IQ. Test instruments were given the two groups to determine whether or not the language delayed group differed from the normal group in their auditory-visual integrative ability, visual-motor integrative ability, or in perception of frequency distorted speech.

The data were treated with the Wilcoxon Matched-pairs Sign-ranked test. Significant differences were found between the two groups in their visual-auditory integrative ability and the perception of frequency distorted speech. There was no difference between the two groups in visual-motor integrative ability. Implications of the results are discussed.

BACKGROUND FOR THE STUDY

That considerable research dealing with the language impaired child is yet needed is axiomatical. Although many researchers have considered the development of language in both normal (Bellugi and Brown, 1964; Berko, 1961; Brown and Fraser, 1964; Lee, 1966; McCarthy, 1954; Mecham, 1960; Menyuk, 1963a, 1963b; Miller and Ervin, 1964; Powers, 1957; Templin, 1957; Winitz, 1959, 1966) and devient children (Brannon and Murray, 1966; Cooper, 1965; Goda, 1959; Heider, 1940; Lennenberg, et al., 1964; Menyuk, 1963; Myklebust, 1954; Scheull, et al., 1964; Woods, 1959, 1964) there are still many unanswered questions. Many of the questions have arisen since the introduction of Chomsky's (1962) transformational grammar and the consequent investigations by Brown and Bellugi (1964); Brown and Fraser, (1964); Miller (1964); Menyuk (1963, 1964a, 1964b); and Lee (1966) relative to the grammatical rules established by the developing child. Some of the most important information to come from these studies is that children do not learn the language solely by imitation but develop a set of rules to generate ι t only the sentence he has heard, but also other possible examples. The child with impaired language has been found to deviate from the normal in the manner in which he developes the grammatical rules of the language; it appears that he may not be simply delayed in his language but that it may be qualitatively different from that of the normal child.

Two questions which become obvious are: (1) How do the various deviant language groups, e.g., deaf, mentally retarded, brain-damaged, and those with non-specific etiologies[1] compare with the normal child in their language system? and (2) What perceptual variables exist within the language impaired child that might account for the development of a deviant language system? The first of the two questions is currently under investigation (Adams, 1968) and a descriptive analysis comparing various groups to normals will be forthcoming. This research will be concerned with the second of the two questions, "What perceptual variables exist within the language impaired child that might account for the development of a deviant language system?" In order to pursue adequately this question it will be necessary to review two areas of interest considered to be prerequisite to its understanding.

---

[1]The term "non-specific etiology" as it is used in this report refers to the delayed language group of children whose chief difficulty appears to be a disturbance of language skills. Neurological, physiological and psychological examinations have revealed nothing which may be considered causalyy related to the disorder.

First we need to consider the normal development of human language. Mowrer (1960) has offered a theory of vocal acquisition which he refers to as the autism theory. He supports his theoretical position with evidence from research with talking birds. According to Mowrer's theory (a) the bird must first identify with the trainer; the trainer becomes a love object, (b) the trainer's voice becomes a stimulus for the presentation of primary reinforcement, (c) the trainer's voice takes on secondary reinforcement properties, (d) the bird produces vocalizations because they are rewarding, and (e) the bird will vocalize in the presence of the trainer because the trainer provides a stimulus for primary reinforcement.

Winitz (1966), following Mowrer's theory, suggests three stages of pre-language utterance learning: (1) fractional anticipatory goal response during which stage the human infant's chewing and sucking responses become conditioned to the events that occur during feeding. "Prominent in the feeding situation are such stimulus elements as (a) the food, (b) the individual administering the food, (c) sensory changes such as variation in light intensity, and (d) the vocalizations of the individual administering the food" (1966, p. 48). (2) Vocalizations as secondary reinforcers. The vocalizations produced by the child become associated with the vocalizations made by the mother preceding presentation of food and thus serve as a secondary reinforcement to him. (3) Verbal stimulus. The acquirement of word meaning is explained by Winitz in terms of a classical conditional mediational model. The presentation of a "cookie" elicits a certain behavioral pattern. When the word "cookie" has been uttered prior to the presentation of the object cookie, the word comes to elicit some portion of the behavior. Using the notational system provided by Osgood (1957) Winitz describes in detail the learning to the word "cookie." The mediational paradigm is given below:

$$\begin{tikzcd} \dot{s} \arrow[rrr] & & & R_t \\ S \arrow[r] & r_m \arrow[r, dashed] \arrow[urr, dashed] & s_m \arrow[r] & R_x \end{tikzcd}$$

We will assume that the stimulus of cookie ($\dot{s}$) has come to elicit certain behavior patterns (R_t) such as salivating, chewing, etc. When the word (S) 'cookie' has been uttered consistently and repeatedly prior to the presentation of the object cookie, the word 'cookie' comes to elicit some portion of the total behavior described above (R_x). R_x is not identical to R_t, but is a distinctive portion of R_t. The short circuited process (is not) identical to R_t, but is a distinctive portion of R_t. The short circuited process by which S elicits R_x is presumed to occur in this way: S elicits a mediating response r_m; r_m is an implicit or representational portion of R_t. The implicit mediating response r_m elicits the mediating stimulus s_m; the self stimulation of s_m evokes the external overt response R_x (Winitz, 1966 p. 50).

Winitz feels that by replacing the parents utterance of "cookie" by the child's utterance of the word, this or paradigms similar to it may possibly be used to explain how the child learns to produce words and eventually sentences. The utterances of the child will at some time be recognized by the parent as words and will be reinforced. The reinforced words will gradually approximate adult forms. Skinner (1957) had discussed the process:

> The parent sets up a repertoire of responses in the child by reinforcing many instances of a response. Obviously a response must appear at least once before it is strengthened by reinforcement. It does not follow, however, that all the complex forms of adult behavior are in the child's unconditioned vocal repertoire . . . In teaching the young child to talk, the formal specifications upon which reinforcement is contingent are at first greatly relaxed. Any response which vaguely resembles the standard behavior of the community is reinforced. When these begin to appear frequently, a closer approximation is insisted upon. In this manner very complex verbal forms may be reached.

Once a vocabulary is established through the process of reinforcement grammar is developed by a generative or transformational model. This model is analogous to a categorization theory of learning which is based on the hypothesis that the organism learns to categorize and assign class membership to given stimuli. In a transformational model it is hypothesized that the child ". . . has incorporated both the generative rules of the grammar and heuristic component that samples an input sentence and by a series of successive approximation determines which rules were used to generate this sentence (Menyuk, 1964)."

Menyuk (1964) sees the rules of the language developing in the same manner as outlines by Skinner, i.e., a "series of successive approximations."

> . . . the data obtained . . . indicate that language acquistion and development are not just dependent on imitation. Some intervening operations seem necessary for the child to be able to organize the data he hears in terms of the grammar of his language and to reproduce them in these same terms. If language production is merely an imitative function, then children should be producing sentences first with omissions, because of the limitations of memory, and then complete sentences (Menyuk, 1964 p. 486).

It appears from the evidence presented that language learning is the result of S-O-R connections. While this may essentially be the case Osgood (1957) and Birch (1949) point out that learning cannot be accounted for in S-O-R theory alone but that learning has been demonstrated to occur as a result of sensory integration (S-S association) as well.

Language, then, is a learned behavior based on bonds formed by a response to stimuli or the temporal contiguity of stimuli. There is inherent in such a theory of learning the demand for accurate perception of the stimuli to which the organism is to respond. This logically leads to a second area which needs to be reviewd in order to allow further consideration of the question under investigation; the role of perception in learning.

In the paradigm of Winitz it can readily be seen that if the mediating response (r_m) does not occur with the repeated utterance of the word "cookie" no mediating stimulus (s_m) occurs to evoke the external response R_x. Thus no verbal learning will occur in this case. Perception obviously plays an important role in learning for the events which take place between S-R are contingent upon the processes which mediate between the sensory impressions and the response to them. Indeed, many studies have demonstrated faulty learning to be the result of perceptual disturbances (Berko, 1954; Berko and Berko, 1954; Dolphin and Cruickshak, 1951; Dunsing and Kephart, 1965; Getman, 1965; Strauss and Lehtinen, 1957).

Strauss and Lehtinen describe perception in terms of Gestalt psychology as a process in which each part of a "whole" is seen or heard or felt in relationship to the other parts, resulting in a figure which is recognized immediately and uniquely. This process may be spoken of as one of integration of parts into a new whole which is more than a mere summation of the parts. This ability to integrate is dependent upon the organization and integrity of the nervous system and the integrity of the entire organism.

Another chareteristic of normal perception is the fact that a "whole" is perceived as a foreground against a background. We do not give equal importance to the numerous sensations received while standing in a room but select a foreground, disregarding all else as background. Every activity is always performed against a background of varying visual, auditory, kinesthetic and cutaneous perception (Strauss and Lehtinen, 1947).

Birch (1962) has posited that the determination which aspects of the environment constitute figure and which constitute background is dependent upon the heirarchical organization of the sensory systems. He illustrates this with a discussion of the hierarchical structuring sequences that the developing child undergoes. In the young infant interioceptive sensory modalities and visceral sensations are predominant. Visual and auditory stimulation are only of secondary importance and constitute background rather than figure in the organization of responses. In normal development the telecreceptive systems come to dominate over visceral and proximal reception. Eventually a complex patterning of behavior comes to be organized around information derived from audition and vision. Not only is there a shift in the hierarchical organization there is also a change in the direction of greater integration of information arriving from the various sense modalities. Birch and his associates have developed a particular interest in sensory integration and have considered it from a phylogenetic and ontogenetic point of view.

Birch and Lefford (1963) have pointed out that from fish to man, the nervous system has progressed in terms of improved interaction among the separate sensory modalites. Multimodal and intersensory control mechanisms develop. In lower phylum the sensory modalities may function independent of each other, whereas in man they become well co-ordinated. The authors discuss two experiments which serve to illustrate the uneveness of development of intersensory liaison:

> As long ago as 1882, the naturalist physician Abbot (1) demonstrated that the frog was incapable of modifying a visually determined response on the basis of information obtained through pain sensation thus, a frog who was permitted to strike at a live fly impalled upon a central post which was surrounded by a sharp pallisade of stakes continued to strike at the moving fly despite the fact that every outthrust of its tongue resulted in its being impalled upon the sharp points of the pallisade.
>
> In contrast, in the same organism, the visually determined striking response is capable of being modified by information received through gustatory avenues of stimulation. Thus, as Schaeffer has pointed out, a frog in very few trials will learn to inhibit its visually determined striking response to a bitter hairy caterpillar (Birch and Lefford, 1963 p. 3).

In contrast to the uneven development of sensory interaction of the amphibian, information deriving from all sense modalities in the adult mammal may be adequately integrated. This liaison constitutes one of the major functions of the cerebral cortex.

Birch and Lefford (1963) and Birch and Belmont (1964a, 1964b, 1965) have made development studies of intersensory integration in normal children and have considered visual-haptic, visual-kinesthetic, haptic-kinesthetic, auditory-visual, and visual-motor integration. Their results have led them to suggest that the interioreceptive sensory modalities develop first ontogenetically while the exteriorceptory serve as background for the organization of a response. Eventually the exterioceptor systems become dominant and the interioceptors serve as background. Their data show that developmentally, the integration of the various modalites (visual-haptic, haptic-kinesthetic, etc.) seem to follow a growth curve and that discrimination abilites precede synthetic abilties.

These same researchers have compared perceptual performance in brain-damaged and normal subjects with reference to their intersensory functioning and found that, although the two groups do not differ significantly from one another in their intra-sensory abilities, the brain-damaged group displayed a significant deficiency in their ability to utilize intersensory information.

Additionally Russian researchers (London, 1954) have amassed a considerable amount of information relative to intersensory liaison. The accumulated evidence suggests strongly that even for relatively simple sensory function the effects produced by the application of a stimulus to a given sense organ is continuously modified by "ongoing activities in the other sense modalities."

Perception, then, is a developmental product in which the interpretation of sensation is not only modified by a previous history of experience with the stimulus but by its association with other stimuli in the same or different sense modalities. It appears that a lack of intersensory liaison will result in a reduction of perceptual performance. It is thought that the reduction of perceptual performance in turn affects the learning processes of the organism.

The question considered in this study was: "What perceptual variables might exist within the language impaired child that might account for the development of a deviant language system?" It was the intent of this investigation to pursue this question in terms of intersensory liason, and specifically to test the following null hypotheses:

1. The language impaired child does not differ from the normal child in auditory-visual integrative ability.

2. The language impaired child does not differ from the normal child in visual-motor integrative ability.

3. The language impaired child does not differ from the normal child in the perception of frequency distorted speech.

STATEMENT OF THE PROBLEM

The capacity of the individual to assimilate and organize multimodal information underlies man's ability to exhibit behavioral plasticity, as well as to modify his behavior. Any disruption in the multimodal integrative process will dimish assimilation of information and hence limit ability.

Birch (1962, 1965), Birch and Belmont (1964a, 1964b, 1965), and Birch and Lefford (1963) have developed a test of audio-visual integration and have shown that retarded readers are very poor in their auditory-visual integrative processes. Many cerebral palsied individuals have been shown to exhibit very poor visuomotor integrative abilities (Birch and Belmont, 1964, 1965; Mecham et al, 1960). McCarthy and Kirk (1963) have developed a test of psycholinguistic abilties based on a model presented by Osgood in which they measure certain integrative processes. Three dimensions are postulated by them to specify a given psycholinguistic ability.

(1) Level of organization, which is broken down into two sublevels: representational level, (activities requiring meaning of linguistic symbols) and automatic-sequential level, (the level which mediates activities requiring retention of linguistic symbol sequences.)

(2) Psycholinguistic processes including decoding (habits required to obtain meaning from visual and auditory stimuli), encoding (habits required for expression), and association (total habits required to manipulate linguistic symbols internally).

(3) Channels of communication describe the sensory-motor path over which linquistic symbols are received and responded to.

In order to test only decoding ability, it is necessary to test only reception of auditory or visual stimuli. To test encoding ability only the response need be specified. When testing associtive ability it is necessary to specify the entire channel.

The test (ITPA) is designed to examine nine psycholinguistic abilities. None of the nine subtests, however, directly examines intermodality integration, but is concerned with the examination of decoding, association, and encoding of visually and auditorially presented stimuli. While McCarthy and Kirk have emphasized the importance of association between decoding and encoding abilities, i.e., visual-motor and auditory-vocal, they have not stressed association between decoding channels, i.e., visual-auditory, visual-tactile, and auditory-tactile.

Numerous studies of language acquisition of normal children and of children with specific neurological disorders have been cited in the literature (Berko, 1961; Berko, 1954; Berko and Berko, 1954; Mecham et al., 1960; Mecham and Jex, 1963; Myklebust, 1954; Strauss and Lehtinen, 1947; Strauss, 1947; Woods, 1959, 1964). The visual perceptual processes have been explored thoroughly (Abercrombie, 1964; Bendel, 1958; Frostig et al., 1964), and the auditory processes have received some attention. While most clinical groups with specific etiologies have been thoroughly examined for perceptual disturbances there is a group of children variously labeled as "delayed speech" or "delayed language" (with non-specific etiologies[2]) who have, for the most part, been considered only in descriptive studies. There is a need to consider the perceptual integrative abilities of this clinical group.

This investigation intends to examine the perceptual integrative abilities of language delayed children with non-specific etiologies[2]. Interest will be confined to two perceptual modalities, vision and audition, both separately and as an integrative unit. It is felt that more information relative to the function of these two perceptual avenues in a group of language delayed children will provide greater insight into their learning problems and suggest therapeutic measures which might lead to greater facilitation of the habilitative process.

This study, then, proposes to answer the following questions:

(1) What are the auditory perceptual components of the delayed language syndrome?

(2) Does this clinical group display visual perceptual disabilities?

(3) Do language delayed children have sub-normal inter-sensory integrative abilities?

---

[2]Previously defined.

METHODS

Selection of subjects

Subjects for this study were six (6) to nine (9) year old children drawn from the St. Louis County, Missouri, Public School system. The experimental group consisted of twelve (12) children previously diagnosed by the diagnostic staff of the St. Louis County, Missouri, Special School District Speech and Hearing Center as language delayed with non-specific etiologies. That is to say, no known etiology that contributes to the delay in language development. The criteria used by the diagnostic staff of the Special School District for determining when a child is language delayed is as follows: two years delayed on the composit score of the Illinois Test of Psycholinguistic Abilities (ITPA), a language age equivalence two years retarded on the Mecham Verbal Language Scale, expressive abilities reduction in productivity as measured by sentence length, delayed morphological acquisition and/or delayed development of syntax, and composit score on the WISC within normal limits but with a discrepancy between performance and verbal scores greater than ten points. Additionally the following restrictions were imposed on the experimental group; normal auditory and visual acuity and absence of obvious neuromuscular involvement. These determinations were made by an audiologist and qualified physician. No child was included in the study who came from a bilingual home or is a twin (Day, 1932).

Each subject in the experimental and control subject was matched within $\pm$ 5 IQ points, full scale on either the WISC or Stanford Binet. The mean IQ score for the control group was 97.5 points, while the mean score for the experimental group was 95.6 pointss. Subjects were matched in age within $\pm$ 3 months. The mean age for both groups was 8 years 1 month.

Testing

Initial evaluations of the children were performed several months before they were experimentally tested for the present study. In order to insure that auditory acuity remained within normal limits, the subjects were screened at 15 dB (ISO, 1964), and only those who passed the screening were allowed to serve as subjects.

The following test battery was administered to the experimental and control groups:

(1) Distorted speech test using a 960 Hz low pass filter (See Appendix C) was presented to the subject at 40 dB above the ambient noise level of the test room. This provides a measure of the integrity of the higher auditory centers (Bocca et al, 1955; deQuirose, 1964; speech sound discrimination can be broadly considered as the interpretation of meaningful sound stimuli by the central mechanism of

Flowers and Costello, 1963).

The filtered speech consisted of a picture word test and was patterened after the procedure discussed by Flowers and Costello (1963).

The test consisted of sixty pictures representing familiar monosyllabic words. Thirty-one of the pictures represented the key word, e.g.: dish, bat; nineteen of the pictures represented a similar sounding word from the key word, e.g., fish (key word), dish (similar picture word). Ten of the pictures served as control items to insure that the child understood the test and was responding properly (See Appendix A).

An example of the distorted speech picture word test is as follows: The key word was fish; the subject was presented a picture and a binaurally presented undistorted carrier phrase, "Is this the picture of a . . .," followed immediately by the binaurally presented distorted word "fish." The subject was requested to answer "yes" or "no" and was scored on his response. In the case of similar words the child was shown the key word (dish) and asked, "Is this the picture of a fish (dish being the key word). Again a yes or no answer was required. After every fifth distorted presentation the carrier phrase and the test word were both presented undistorted to the child to allow the examiner to determine if the child was responding correctly.

(2) The Berry-Buktenica Developmental Test of Visual Motor Integration (1967). This test is designed to test visuo-motor integrity through reproduction of geometric forms by the child.

While the Berry-Buktenica Test is a test of visual-motor integration it also examines visual perception and motor control. It is obvious that poor visual perception per se, or poor motor control will affect the level or quality of form reproduction. Berry (1964) believes "pure" cases of visual imperception or lack of motor control occur only infrequently. If, however, the existing problem is one of visual imperception or lack of motor control rather than a breakdown of intersensory liason,such may be identified. Koppitz (1964) has provided a guideline. If the problem is motoric, the child will recognize his errors of reproduction; if it is perceptual he will not recognize his errors.

The child was required to copy geometric forms with a pencil, withoug erasing or marking over, in the order prescribed by the test. The child copied the form until he failed three consecutive items.

(3) The Birch audio-visual integration test. This examines the integrative perceptual performance of the subject by having him match acoustically perceived taps with visually presented dots (Birch, 1965; Birch and Belmont, 1964, 1965).

Various patterns (See Appendix B) of dots separated, in time were presented to the child and the corresponding patterns, spatially separated were immediately presented upon completion of the auditorially presented pattern placed among a group of similar but different patterns. The following testing procedure was as follows: The child sat opposite the examiner. The examiner said, "I am going to tap out some patterns with this small hammer. Listen." Using the top of the table, the examiner then tapped out several patterns while he simultaneously displayed the visual pattern. The examiner then told the child, "See, the taps sound like the dots look. Now listen carefully and see if you can match the taps with the dots you see. Listen carefully, for I may try to fool you." The sample patterns were then tapped out and matches made by the child. If he understood the task, the test items were presented and scored.

The specific null hypothesis to be considered are:

1. There will be no difference between the experimental and control group in their ability to understand distorted speech.
2. There will be no difference between the experimental and control group in their visual-motor integrative ability.
3. There will be no difference between the experimental and control group in their auditory-visual integrative ability.

FINDINGS AND ANALYSIS

The data were treated with a non-parametric measurement, the Wilcoxon matched-pairs sign-ranked test (Siegel, 1956) using the formula:

$$\frac{\dfrac{Z = T - N(N+1)}{4}}{\dfrac{N(N=1)\quad(2N=1)}{24}}$$

There were no significant differences in the scores obtained between the experimental and control group for the Berry Buktenica Developmental Sequence test. Significant differences did exist, however, between the experimental and control groups for both the Birch Auditory-visual test and the distorted speech test; with poorer performance by the experimental group of both tests. The data are presented in Tables I through III.

The null hypothesis related to no difference between the language impaired and the normal child for visual-motor integrative abilities was not rejected. However, the hypothesis of no difference between the language impaired and normal child for both auditory-visual, and frequency distorted speech test were rejected in favor of the alternate hypothesis:

Discussion

The forgoing questions can, of course, only be answered specific to the measuring tools used by this study. The mean score achieved by the language delayed on the filtered speech test group was significantly poorer than the mean scores achieved by the normal subjects, suggesting poorer auditory perception.

The distorted speech tests which have been utilized (Bocca et al, 1955) are generally capable of identifying these patients who may have various central nervous system pathology including the central auditory system. Additionally it has been shown that such a procedure can differentiate those suspected of subtle aberration of central hearing (Flowers and Costello, 1963) from a normal population.

It appears, then, that the delayed language population considered in this investigation does exhibit some auditory perceptual difficulty probably due to subtle aberration of central hearing. While the relationship between poor performance on distorted speech testing and poor articulation skills has been demonstrated (Flowers and Costello, 1963) no such relationship has been shown to exist between poor distorted speech discrimination ability and language skill. If

TABLE I

BERRY BUKTENICA DEVELOPMENTAL FORM SEQUENCE TEST:

Experimental data and statistical treatment

Control Group	Exp. Group	Diff.	Rank	Rank with less frequent sign
15	10	5	8	
11	16	-5	-8	-8
16	14	2	5	
15	16	-1	-2.5	-2.5
13	14	-1	-2.5	-2.5
9	17	-8	-11	-11
11	14	-38	-6	-6
16	11	5	8	
12	11	1	2.5	
13	12	1	2.5	
18	18	0		
20	14	6	10	
			N=11	T=30
			p > .05	

TABLE II

DISTORTED SPEECH WORD PICTURE TEST:

Experimental Data and Statistical Treatment

Control Group	Exp. Group	Diff.	Rank	Rank with less frequent sign
30	22	8	7	
35	26	9	8.5	
23	23	0		
22	19	3	2	
37	32	5	4	
23	20	3	2	
35	28	7	6	
19	25	-6	-5	-5
34	25	9	8.5	
33	20	13	10	
31	34	-3	-2	-2
30	30	0		
		N=10		T=7

$p < .05$

TABLE III

BIRCH AUDIO-VISUAL INTEGRATION TEST:

Experimental Date and Statistical Treatment

Control Group	Exp. Group	Diff.	Rank	Rank with less frequent sign
9	4	5	9	
10	4	6	10.5	
3	6	-3	-5.5	5.5
7	5	2	2.5	
8	2	6	10	
8	4	4	8	
6	9	-3	-5.5	5.5
5	2	3	5.5	
8	2	6	10.5	
7	5	2	2.5	
5	4	1	1	
6	3	3	5.5	
			N=12	T=11

$p < .05$

speech sound discrimination can broadly be considered as the interpretation of meaningful sound stimuli by the central mechanism of hearing, then it follows that any aberration which interfers with the central auditory processes will disrupt (however slight) interpretation of meaningful stimuli by the organism. It may be that such a disruption plays a much larger role in articulation skills than language skills; this determination was not made in the present research.

Closely related to the problems involved with auditory perception are those associated with inter-sensory integrative abilities. Do language delayed children have sub-normal abilities? Generalizations cannot be made to all sensory modalities; only those considered specifically in this investigation. There was no difference between the experimental and central groups in their visual-motor integrative abilities. there were, however, significant differences between the two groups for auditory-visual integration. Some difficulties arise, however, in attempting to answer the question. There was a significant difference between the two groups in auditory perception, thus one cannot know if the difference found between the two groups for the auditory-visual integrative task is a difference which can be attributed to lack of inter-sensory liasion or merely to the auditory perceptual component. More research is required to determine which is more disturbed in the language delayed child; auditory perception or the auditory integrative processes.

APPENDIX A

Picture Word Test

1. Is this a picture of a dish?
2. Is this a picture of a wreck?
3. Is this a picture of a cat (hat)?
4. Is this a picture of a nest?
5. Is this a picture of a clown?

*. Is this a picture of a bear (chair)?

6. Is this a picture of a bus?
7. Is this a picture of a rat?
8. Is this a picture of a bat?
9. Is this a picture of a dog?
10. Is this a picture of a tire (fire)?

* Is this a picture of a ball?

11. Is this a picture of a frog?
12. Is this a picture of a rose?
13. Is this a picture of a cat?
14. Is this a picture of a dish (fish)?
15. Is this a picture of a bug?

* Is this a picture of a ball (doll)?

16. Is this a picture of a vase (face)?
17. Is this a picture of a peg (bed)?
18. Is this a picture of a tree?
19. Is this a picture of a tire?
20. Is this a picture of a cat (bat)?

* Is this a picture of a bear?

21. Is this a picture of an ax?

22. Is this a picture of a rock (sock)?

23. Is this a picture of a nose?

24. Is this a picture of a bee?

25. Is this a picture of a suit?

* Is this a picture of a baby (lady)?

26. Is this a picture of ants?

27. Is this a picture of a box?

28. Is this a picture of fire?

29. Is this a picture of a five (hive)?

30. Is this a picture of a dog (log)?

* Is this a picture of a horse?

31. Is this a picture of a knife?

32. Is this a picture of a bug (rug)?

33. Is this a picture of a cart (dart)?

34. Is this a picture of a tree (key)?

35. Is this a picture of a ship?

* Is this a picture of a desk?

36. Is this a picture of a nurse (purse)?

37. Is this a picture of a sled?

38. Is this a picture of a purse (nurse)?

39. Is this a picture of a box (fox)?

40. Is this a picture of a room (broom)?

* Is this a picture of a top?

41. Is this a picture of a home (bone)?

42. Is this a picture of a nose (hose)?

43. Is this a picture of a rake?

44. Is this a picture of sheep?

45. Is this a picture of an elf?

46. Is this a picture of a shop (mop)?

* Is this a picture of a wolf?

47. Is this a picture of a screw?

48. Is this a picture of a dad?

49. Is this a picture of nuts?

50. Is this a picture of a barn?

* Is this a picture of a mouse (house)?

APPENDIX B

Birch Audio-Visual Test

NAME AGE

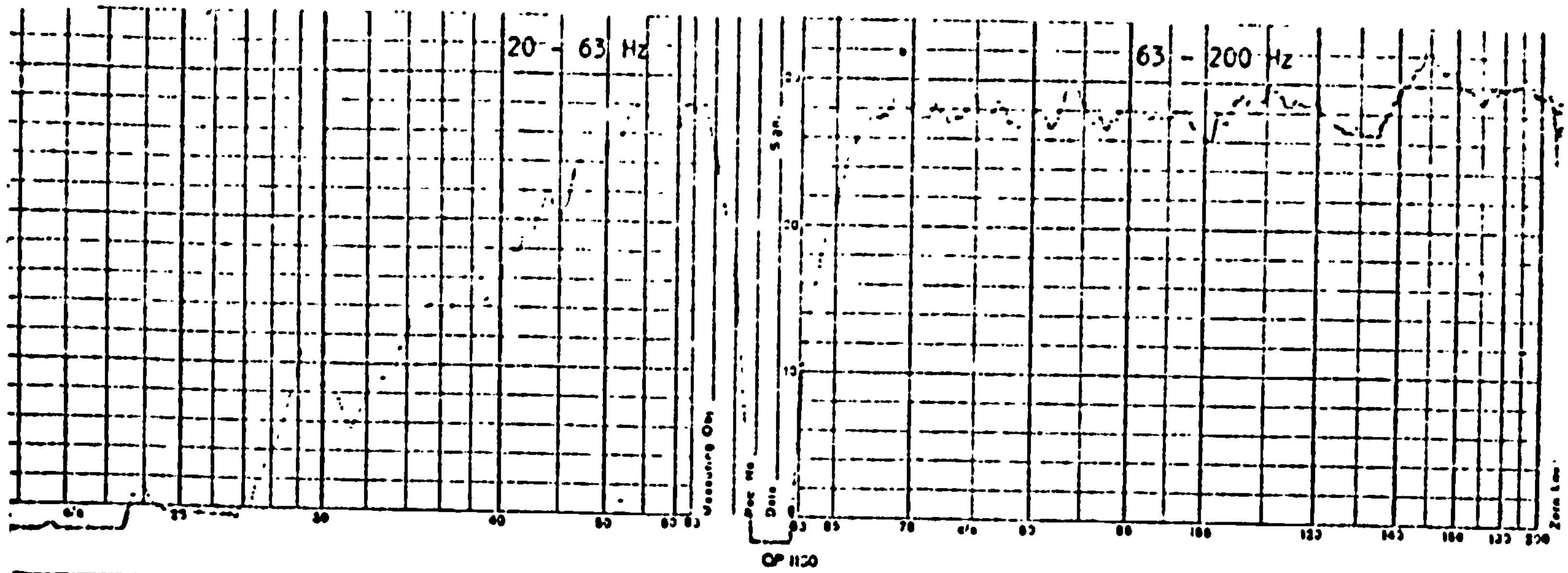
	AUDITORY TAP PATTERNS	VISUAL STIMULI		
		EXAMPLES		
a	• •	••	• •	•••
b	• ••	•••	• ••	•• •
c	•• •	•••	• ••	•• •
		TEST ITEMS		
1	•• ••	• •••	• •• •	•• ••
2	• •••	••••	• •••	••• •
3	••• ••	•••••	•• •••	••• ••
4	• •• •	• •• •	•••••	•• ••
5	••• •• •	••• •• •	•• ••• •	• ••• ••
6	•• •••	••• ••	•• •••	•••• •
7	•• •• ••	•• •• ••	•••• ••	••• • ••
8	••• ••• •	• •• •••	••• •• ••	••• ••• •
9	•• • •••	•• •• ••	•• • •••	•• ••• •
10	• ••• ••	•• ••• ••	• ••• ••	•• • ••

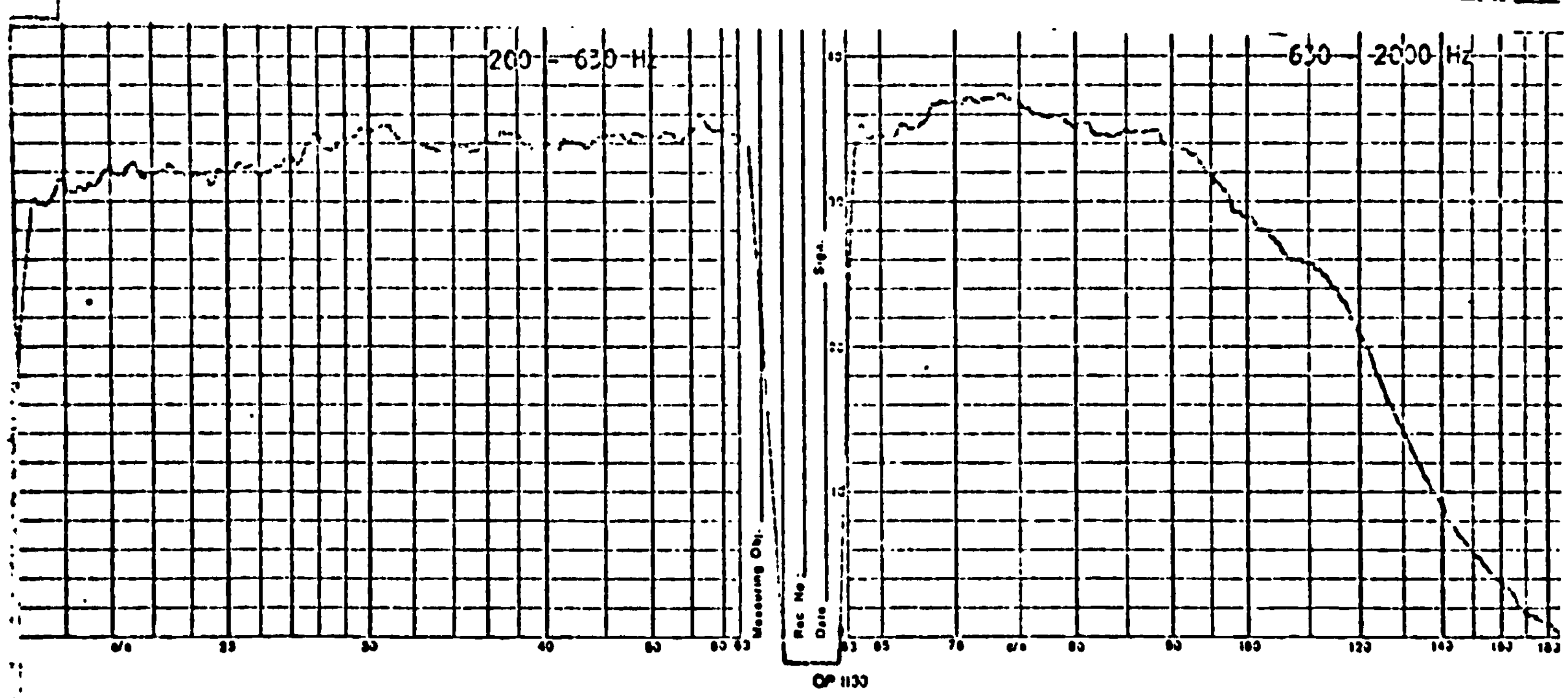
APPENDIX C

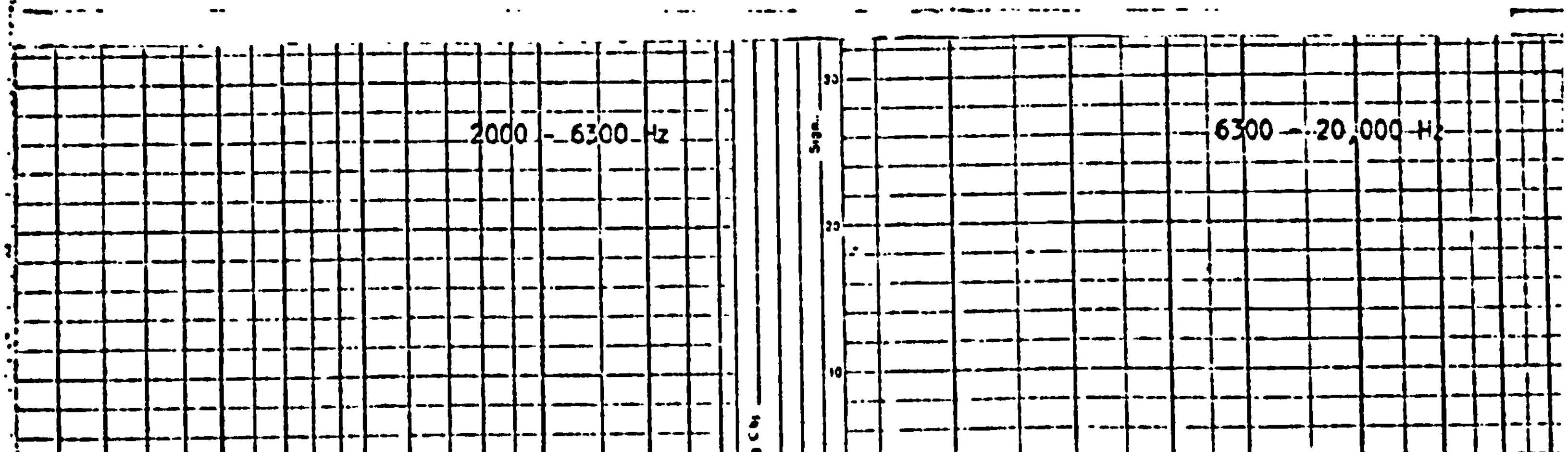
In order to achieve the desired spectrum shaping it was necessary to use carefully controlled instrumentation. Inasmuch as Flowers and Costello (1966) reported a 960 Hz Low pass filter to be the most effective with children the instrumentation was arranged such that this value could be achieved.

White noise was passed through a Bruel and Kjaer Spectrum Shaper, Model 123, and recorded on magnetic tape by a Wollensak, Model T-10. The recorded white noise was then fed through a Bruel and Kjaer Artificial Ear, Model 452 and into a Bruel and Kjaer Graphic Level Recorder, Model 2305A. After examination of the graphic recording of the frequency response the Spectrum Shaper was adjusted until the desired cutoff (960 Hz) was obtained. (See the figure below).

A speaker then talked into a Bruel and Kjaer condensor microphone, Type 4132, connected to the Spectrum Shaper, which in turn was connected to a Wollensak, Model 10 recorder. The speaker spoke the carrier phrase, "Is this a picture of______" without the filtering network in the circuit. The network was mechanically placed into the circuit with a toggle switch and the distorted word presented. Thus the undistorted carrier phrase, "Is this a picture of______" was immediately followed with the distorted word. Sentences were repeated in fifteen second intervals.


20 - 63 Hz
63 - 200 Hz
OP 1130


200 - 630 Hz
630 - 2000 Hz
OP 1130


2000 - 6300 Hz
6300 - 20,000 Hz
OP 1130

BIBLIOGRAPHY

1. ABBOT, C. "The Intelligence of Batrachians," Science, 3(1882), 66-67.

2. Abercrombie, M. L. J. "Perceptual and Visuo-motor Disorders in Cerebral Palsy," in Little Club Clinics in Developmental Medicine. London: William Heineman Medical Books Ltd., 1964.

3. Adams, Sister Marie Damien. "A Descriptive Linguistic Investigation of Language Problems in Pre-school Children." In progress.

4. Beery, Keith. Geometric Form Reproduction. Unpublished manuscript, 1964.

5. Beery, Keith and N. A. Buktenica. The Beery-Buktenica Developmental Form Sequence (Experimental edition), Chicago: Follett Publishing Co., 1967.

6. Bellugi, Ursula and Roger Brown. "Acquisition of Syntax," Monographs for the Society for Research in Child Development, 29(1964).

7. Belmont, Ira, et al. "The Disordering of Intersensory and Intrasensory Integration in Brain-damage," Journal of Nervous and Mental Disorders, 141(1965), 410-418.

8. Bender, L. "Problems in Conceptualization and Communication in Children with Developmental Dyslexia," in Hock and Zubin (eds), Psychopathology of Communication. New York: Grune and Stratton, 1958, 155-176.

9. Berko, Jean. "The Child's Learning of English Morphology," In Saporta, Sol (ed), Psycholinguistics: A Book of Readings. New York: Holt, Rinehart and Winston, 1961, pp. 359-371.

10. Berko, M. J. "Some Factors in the Perceptual Deviation of Children with Cerebral Palsy, " Cerebral Palsy in Review, 15(1954), 3-4.

11. ________ and F. J. Berko. "Implications of Language Difficulties in the Cerebral Palsied Adult," Cerebral Palsy Review, 15(1954), 8-9, 19, 27.

12. Birch, H. G. "Reinforcement and Learning Theory: The Process of Sensory Integration," Psychological Review, 56(1949), 292-307.

13. ________. "Dyslexia and the Maturation of Visual Function." In Money, J. (ed) Reading Disability. Baltimore: The Johns Hopkins Press, 1962. Chapter 10.

14. ________ and Ira Belmont, Perceptual Analysis and Sensory Integration in Brain-damaged Persons," Journal of Genetic Psychology, 105(1964), 173-179.

15. ________ and Lillian Belmont. "Auditory-visual Integration in Normal and Retarded Readers," American Journal of Orthopsychology, 34(1964), 853-861.

16. ________ and Lillian Belmont. "Auditory-visual Integration in Brain-damaged and Normal Children," Developmental Medicine and Child Neurology, 7(1965) 135-144.

17. ________. "Auditory-visual Integration, Intelligence and Reading Ability in Children," Perceptual and Motor Skills, 20(1965), 295-305.

18. Birch, H. G. and Lefford, A. "Intersensory Development in Children." Monograph of the Society for Research in Child Development," 28(1963) serial #89.

19. Bocca, E., et al, "Testing Cortical Hearing in Temporal Lobe Tumors," Acta-Oto-Laryngologica, 45(1955), 289-303.

20. Brannon, John and Thomas Murry. "The Spoken Syntax of Normal, Hard-of-hearing and Deaf Children," Journal of Speech andHearing Research, 9(1966), 604-610.

21. Brown, Roger and Ursula Bellugi. "Three Processes in the Child's Acquisition of Syntax," Harvard Educational Review. 29(1964), 43-78.

22. ________ and Colin Fraser. "Acquisition of Syntax," In Bellugi, Ursula and Roger Brown (eds) Acquisition of Language, Monographs for the Society for Research in Child Development, 29(1964), 43-78.

23. Carroll, John. "Language Development in Children," in Saporta, Sol (ed), Psycholinguistics: A Book of Readings. New York: Holt, Rinehart and Winston, 1961, pp. 331-345.

24. Chomsky, Noam. Syntatic Structures. The Hague: Mouton and Co., 1962.

25. Cooper, Robert L. "The Development of Morphological Habits in Deaf Children," in Rosenstein, Joseph and B. MacGinitie (eds), Research Studies on the Psycholinguistic Behavior of Deaf Children. Research Monographs of the Council for Exceptional Children, B2(1965), 3-11.

26. Day, Ella J. "The Development of Language in Twins: I. A. Comparison of Twins and Single Children," Child Development, 3(1932), 179-199.

27. de Quiros, J. B. "Accelerated Speech Audiometry: An Examination of Test Results," Translations, June, 1964, #17. New York: Belton Institute for Hearing Research.

28. Dolphin, J. E., and William Cruickshank. "Visuo Motor Perception in Children with Cerebral Palsy," Quarterly Journal of Child Behavior, 3(1951), 198-209.

29. __________ and William Cruickshank. "The Figure-background Relationship in Children with Cerebral palsy," Journal of Clinical Psychology, 7(1951), 228-231.

30. Dunsing, Jack D. and Newell Kephart. "Motor Generalizations in Space and Time," in Hellmuth, Jerome (ed), Learning Disorders Volume 1. Seattle: Special Child Publications of the Seattle Sequin School, Inc., 1965, pp. 1-29.

31. Flowers, Arthur and Mary Rose Costello. "Responses to Distorted Speech of Children with Severe Articulation Disorders," Journal of Auditory Research, 3(1963) 133-140.

32. Frostig, M., et al. Administration and Scoring Manual Developmental Test of Visual Perception. Palo Alto: Consulting Psychlogists Press, 1964.

33. Getman, G. N. "The Visuomotor Complex in the Acquisition of Learning Skills," in Hellmuth, Jerome (ed), Learning Disorders Volume 1. Seattle: Special Child Publications of the Seattle Seguin School, Inc., 1965, pp. 49-76.

34. Goda, Sidney. "Language Skills of Profoundly Deaf Adolescent Children," Journal of Speech and Hearing Research, 2(1959), 369-376.

35. Heider, F. K. and Grach Heider. "A Comparison of Sentence Structure of Deaf and Hearing Children," Psychological Monographs, 52(1940), 42-103.

36. Koppitz, E. M. The Bender Gestalt Test for Young Children. New York: Grune & Stratton, 1964.

37. Lee, Laura. "Developmental Sentence Types: A Method for Comparing Normal and Deviant Syntactic Development." Journal of Speech and Hearing Disorders, 31(1966), 311-330.

38. Lenneberg, Eric, et al. "Primitive Stages of Language Development in Mongolism," Disorders of Communication, 42(1964), 119-137.

39. London, Ivan D. "Research on Sensory Interaction in the Soviet Union," Psychological Bulletin, 51(1954), 531-568.

40. Maier, N. R. F. and T. C. Schneirla. Principles of Animal Psychology, New York: McGraw-Hill, 1935.

41. McCarthy, Dorothea. "Language Development in Children," in Carmichael, Leonard (ed), Manual of Child Psychology, New York: John W. Wiley, 1954. Chapter 9.

42. McCarthy, James J. and Samuel A. Kirk. Illinois Test of Psycholinguistic Abilities. Madison: Photo Press, Inc., 1963.

43. _________. "The Language Development of the Preschool Child," Child Welfare Monographs, 4(1930), Minneapolis: University of Minnesota Press, 1930.

44. Mecham, Merlin, et al. Speech Therapy in Cerebral Palsy. Springfield: Charles C. Thomas, 1960.

45. _________ and Lorin Jex. "Training Mentally Retarded Children in Oral Communication," ASHA, 4(1963), 441-443.

46. Menyuk, Paula. "A Preliminary Evaluation of Grammatical Capacity in Children," Journal of Verbal Learning and Verbal Behavior, 2(1963), 429-439.

47. _________. "Comparison of Grammar in Children with Functionally Deviant and Normal Speech," Journal of Speech and Hearing Research 7(1964), 109-121.

48. _________. "Alternation of Rules in Children's Grammar," Journal of Verbal Learning and Verbal Behavior, 3(1964), 480-488.

49. _________. "Syntactic Structures in the Language of Children," Child Development, 34(1963), 407-422.

50. Miller, Wick and Susan Ervin. "The Development of Grammar in Children's Language," Acquisition of Language. Monographs for the Society for Research in Child Development, 29(1964), 9-34.

51. Mowrer, O. H. Learning Theory and the Symbolic Processes, New York: John Wiley and Sons, Inc., 1960.

52. Myklebust, Helmer. Auditory Disorders in Children. New York: Grune and Stratton, 1954.

53. Osgood, Charles E. "The Nature and Measurement of Meaning," Psychological Bulletin, 49(1952),197-237.

54. ________. "Motivation Dynamics of Language Behavior," Nebraska Symposium on Motivation. Lincoln: University of Nebraska Press, 1957, pp. 348-424.

55. Paine, Richmond S. "Organic Neurological Factors Related to Learning Disorders," in Hellmuth, Jerome (ed), Learning Disorders Volume 1. Seattle: Special Child Publications of the Seattle Seguin School, Inc. 1965, 1-29.

56. Powers, Margaret Hall. "Functional Disorders of Articulation - Symptomology and Etiology," in Travis, Lee E. (ed), Handbook of Speech Pathology. New York: Appleton-Century-Crofts, Inc., 1957, 707-798.

57. Scheull, Hildred, et al. Aphasia in Adults. New York: Hoeber Medical Division, Harper and Row, 1964.

58. Siegel, Signey. Nonparametic Statistics. New York: McGraw-Hill Book Co., Inc., 1956.

59. Skinner, B. F. Verbal Behavior. New York: Appleton-Century-Crofts, Inc., 1957, pp. 29-30.

60. Strauss, A. A. and L. Lehtinen. Psychopathology and Education of the Brain-injured Child. New York: Grune and Stratton, 1947.

61. ________. "Aphasia in Children," American Journal of Physical Medicine, 33(1954), 93-99.

62. Templin, Mildred. "Certain Language Skills in Children," Child Welfare Monographs, No. 26. Minneapolis: University of Minnesota Press, 1957.

63. Winitz, Harris. "Language Skills of Male and Female Kindergarten Children," Journal of Speech and Hearing Research, 2(1959), 377-386.

64. ________. "The Development of Speech and Language in the Normal Child," in Reiber, R. W. and S. Brubaker (eds), Speech Pathology. Amsterdam: North Holland Publishing Co., 1966. Chapter 3.

65. Woods, Nancy. Language Disorders in Children. The National Society for Crippled Children and Adults, Inc. Monograph,, 1959.

66. ________. Delayed Speech and Language Development. Englewood: Prentice-Hall, Inc., 1964.

ABSTRACT

A review of the literature dealing with language impaired children revealed that while many studies have dealt with language acquisition of normal children and children with specific neurological disorders, and their perceptual modalities explored thoroughly, that children with non-specific etiologies have been considered only in descriptive studies.

The present investigation examined the perceptual integrative abilities of language delayed children with non-specific etiologies. Specifically the investigation compares the visual-auditory integrative ability of twelve language-delayed children with twelve normal children matched for age, sex and IQ.

Test instruments were given to the two groups to determine whether or not the language group differed from the normal group in their auditory-visual integrative ability, visual-motor ability, or in perception of frequency distorted speech.

The data were treated with the Wilcoxon Matched-pairs Sign-ranked Test. Significant differences were found between the two groups in their visual-auditory integrative ability and the perception of frequency distorted speech. There was no difference between the two groups in visual-motor integrative ability. Inasmuch as the two groups were significantly different for the auditory perceptual task it is difficult to determine if the differences which exist between the two groups in the area of auditory-visual integrative skills is due to poor integration between these two modalities or due merely to the auditory component. Further research is indicated.