The *Relationship Between* Articulation and *Discrimination* of *Kannada Speech Sounds in Terms of* Distinctive Features

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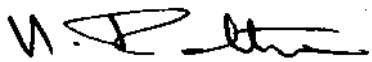
CERTIFICATE

This is to certify that the dissertation entitled "The Relationship between artiou-lation and Discrimination of Kannada Speech Sounds in terms of Distinctive Features" is the bonfide work in part fulfilment for M.Sc., in Speech and Hearing, carrying 100 marks, of the student with Register NO. 15.



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This is to certify that this dissertation has been prepared under my supervision & guidance.

DECLARATION

This dissertation is the result of my own Study undertaken under the guidance of Dr. N. Rathna, Protestor in Speech pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier at any university for any other diploma or degree.

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CHAPTER I

INTRODUCTION

"It seems logical that the learned discriminations among different speech sounds must occur prior to or simultaneously with the phonetic and phonemic learing processes" (winitz, 1969).

Auditory discrimination has long held the inrerst of Speech pathologists. It has been linked, at least hypothetically, to articulation defects as an important etiological factor. Probably the most widely accepted speech therapy programmes (Van Riper, 1954, Van Riper & Irwin, 1968) have been based en the supposition that this hypothesised link is a valid one.

The discrimination ability of children has not been studied extensively. A few studies have shown that discrimination ability improves with maturation (Templin, 1957), The concept of distinctive features developed by Jakobson, pant and Halls (1952) has been very useful in the study of discrimination ability. Jakobson (1941) has suggested that there is an orderly sequence in the development of speech sound discrimination and that this sequence is based on the degree of physical difference

between phonemes. Though Jakobson claims that the pattern he has set forth is univeraal, there are not many studies to support his hypothesis.

It has also boon suggested (Winitz, 1669) that the Child's understanding of the adult phoneme system or a portion thereof, antedates any attempt by him to utter language units. We need to know whether the active system develops at the same rate and in the same order as the passive system. Also, we need to know whether these two systems actively interest.

Though nothing is known about the interaction between the active and the passive systems, impaired discrimination haa been considered one of the important etiological factors in misarticuiation. Considerable research has been directed toward the study of discrimination ability of subjects with defective articulation. Normal subjects have been found to perform significantly better than articulatory defective children on tests of discrimination.

Most of the investitgators have compared the discrimination score of the articulatory defective group with that of the control group without regard to the specific sounds that are misarticulated. But some have attempted to analyse speech sound discrimination in a more specific way and to relate discrimination errors to specific articulation errors.

No study has been done on Indian Languagea to verify Jakobson's hypothesis. Though the sample of the present study is not large enough for that purpose, children at different age levels can be compared to see if there is say pattern in the development of discrimination.

Since there was no test for discrimination Kannada the language generally spoken in Mysore state, the purpose of the present study was to develop a test for discrimination in Kannada using distinctive features and to adminiater it to a group of school-going children to see if there is any pattern in the development of discrimination and to see if there is any relationship between articulation and discrimination.

The discrimination test comprised minimal pairs differing in one or two distinctive features. Four pairs of pictures represented each word pair in four poasible combinations. The child's task waa to point to the picture pair which he thought was named. The child's oral response to these picture-pairs were recorded to assess his articulation.

The study intended to answer the following questions:

1. Is there any pattern in the development of discrimination?

2. Is there any relationship between misarticulation and mispereeption? in other words, are the sounds and/or distinctive features that are misarticulated also misperceived ?

3. Is there any relationship between discrimination and specific classes of articulation error ?

Hypotheses

(1) There is a pattern in the development of discrimination.

(ii) There is no relationship between Articulation and discrimination.

limitations

1. Many items could not be included in the test because the words had to be picturable in addition to being familiar to young children. Therefore, the test does not measure aound discrimination ability on all combinations of sound-pairs desired.

2. The sample of the presented study of is restricted to school-going children.

Definitions

Speech-sound discrimination : This generally refers to the ability to distinguish between speech sounds. However, in the present study it refers to the ability to discriminate between minimal word pairs differing in one or two distinctive features.

Distinctive Features: "The distinctive features of an individual phoneme would be those aspects of the process of articulation and their acoustic consequences

that serve to contrast one phoneme with others" (Berko & Brown, 1960, pp.525-526). Each feature is characterized in both articulatory and acoustic terms and each is conceived as operating on a two-altemative basis.

Misarticulation : Misarticulation as used here refers to incorrect production of a speech sound with reference to adult production, irrespective of the age of the child. It includes :

(i) Omission-the desired phoneme is not uttered,

(ii) Substitution-one phoneme is substituted by another phoneme of Kannada,

(iii) Mild distortion - the sound is not uttered correctly, but is identifiable as the desired phoneme,

(iv) Severe Distortion - the uttered sound is not identified as tha desired phoneme or as any other phoneme of Kannada.

CHAPTER II

REVIEW 0F LITERATURE

There are not many studies regarding the development of speech sound discrimination in children,

We have only the tentative formulations of Jakobson (1941), who believes that phonological development, viewed as the progressive differentiation of phonemes of the community language, reveals universal human regularities. Jakobson and Halle (1966) believe that the child begins in a "Labial stage" in which his only utterance is /pa/. This involves the consonant-vowel contrast. The acquisition of subsequent phonemic distinctions are assumed to be an orderly one in that the greatest possible phonemic distinctions are made first, with smaller differentiations following later. Jakobson, Fant and Halle (1966) have listed twelve distinctive features, each characterised in both articulatory and acoustic terms,which are presumably adequate far the specification of the phonemes of all languages. The basic idea behind the distinctive feature concept ia that the receiver of a message, when listening, is confronted with a two-choiced situation and consequently has to choose either between two polar qualities of the same category (grave vs acute, compact Vs diffuse), or between the presence

or absence of a given quality (Voiced Vs Unvoiced, nasalised Vs non-nasalized). All identification of phonamic units thus supposes a binary code.

The concept of distinctive feature has been applied by a few investigators to the study of the discrimination ability of children and adults. Koenigskneeht and Lee (1968) examined the speech sound discrimination of 3 -year old children. Every English consonant in initial and final position was compared to other consonants which differed in terms of a varying number of features from the key consonant. The children were asked to show the picture of the key word every time they heard it. The overall rank order of errors, in terms of confusion of features, from least to most errors was nasality, voicing, continuancy and place. Interestingly, the same rank order of case of discrimination of distinctive features was found by Miller and Nicely (1966) who studied perceptual confusions among selected English consonants. They reported that changes in place of articulation tended to bo the most difficult for auditory discrimination.

There have been very few studies examining how children categorise a range of acoustic signals which cross speech boundaries. It has been found that 3-year old children categorise signals which vary from /i/ to /I/ to /E/ very much the way adults do (Menyuk and Anderson, 1969). It

has also been found that children (age 4 to 5 years) categorise signals that range from /w/ to /r/, /w/ to /l/, and /r/ to /l/ vary much the way adults do, but have greater difficulty than do adults in categorizing signals in these ranges when asked to make a three-chocie identification. (/w/, /r/, or /l/). Children do not reproduce the stimuli in these ranges as well as they identify them in both the two-choice and the three-choice situations. For the most part, the tendency is to reproduce the stimuli as /w/. These results indicate that children of this age can perceptually identify members of this set better than they can reproduce them Though there are not many studies regarding the discrimination skills of children, impaired discrimination ability haa been considered one of the major etiological factors of,misarticulation.

To test this hypothesis, considerable research has been directed toward the study of discrimination ability in groups of children with and without misarticulatlon.

The first investigation comparing defective and normal subjects was conducted by Travis and Resmus in 1931. They studied three paired groups of defective and normal speaking subjects. For all the three pairs of groups the normal group performed significantly better than the

defective group. This finding was confirmed by reid (1947), Kronvall and Dichl (1954)and Cohm and Diehl (1963).

Ha11 (1938) compared control and experimental groups of children on two tests of discrimination and did not find significant difference between the groups.

Clark (1959) reported that articulatory defective children performed significantly poorer than non artlcu-latory defective children on the folloqwing discrimination tests: vowels, consonants, and words and phrases. The first two tests consisted of pairs of 'same' or 'different items. The vowel and consonant tests had 12 items. The word and phrase test consisted of a series of 15 cards, each card having two pictures on it. The picture repre-sented objects or events whose names had common sound elements, the subject was to identify one of the two pictures by name in response to a word or a phrase.

Prins (1963) did not find a significant difference between the experimental and control group of first-grade subjects on a word discrimination test.

Costello and Flowers (1963) tested articulatory defective and normal speaking children on two tests of

discrimination, "filtered speech" test and "binaural summation" test. The experimental group scored below the control group.

Taking a different experimental strategy, Sherman and Geith (1967) categorized subjects on the basis of discrimination scores and then made articulatory measurements. The high ranking subjects articulated correctly more sound items than the low,ranking subjects.

In three studies the discrimination of adult subjects with varying levels of articulatory proficiency was tested. Travis and Rasmus (1931) compared 223 adult normals with 62 defective adults on a 366-item discrimination test. The normal adults performed significantly better than the defective adults.

Hall (1938) tested college freshmen and did not find a significant difference between the experimental and control groups.

Hansen (1944) after comparing the discrimination ability of trained and untrained articulatory defectives with that of normals concluded that there was no significant difference between the groups in discrimination ability.

Winits (1969), after a brief review of literatures concludes .

> . . . . . for children at least, the evidence overwhelmingly supports the point of view that crticulatory defective children acore below non-articulatory defective children on tests of speech sound discrimination (p. 186).

Most of the studies reviewed above involved comparison of the overall discrimination ability of experimental and control groups, and most of them have revealed significant difference between the two groups. Many speech Pathologists have assumed that this discrimination deficit is a general rather than a specific one and articulatory defectives have been studied, for the most part, as a group without regard to the specific sounds in error. It is revealed by several studies that specific discrimination errors do accompany specific artlculatory errors though this may be masked by overall scores. It is perhaps for this reason that some studies have reported to difference between experimental and control groups. possible factors contributing to the discrepancy could be number of sounds misarticulated, the type of articulatory error and the discrimination test used.

Discrimination as a function of learning

Anderson (1949) found that a greater percentage of /s/ discrimination errors occured in contexts in which subjects misarticulated the /S/ sound than in contexts

in which they had no articulation difficulty.

Prins (1963) studied the relationahlp between articulation problems and auditory discrimination. Taking the group as a whole there was no significant relationship between articulation errors and sound discrimination. But there was a definite connection between poor auditory discrimination and one class of articulation error : those children who made high proportions of phonemic substitution errors involving change of only a single articulatory feature, in a particular place of articulation, tended to show poor auditory discrimination, while children who made large proportions of articulation errors which differed grossly from intended phonemes in the combined features of manner, place of articulation and voicing did not. Prins had used Wepman's Auditory Discrimination Test (1958). Here, the contrastive elements involve changes in place of articulation, while manner and voicing are kept constant. Thus, the findings of this study lend support to the hypothesis that discrimination and articulatory sound errors are related when the measurements involve similar phonetic or contextual dimensions.

The significant correlation of place change articulatory substitution errors with the score on the Wepman test is of interest when related to the study of perceptual confusions among selected English consonants by Miller and Nicely (1956).

Aungst and Prick (1964) investigated the relation between the production and discrimination of the /r/ phoneme. The discrimination test consisted of thirty items, each containing a variant of the /r/ phoneme. The /r/ production test (articulation test) consisted of fifty items in which allophones of the /r/ phoneme were tested. In addition, the Templin fifty item discrimination test was administered.

On the /r/ articulation test the subjects averaged its errors out of 50, and about 19 errors on each of the three /r/ discrimination teats. On the Templin test the mean number of correct responses was about 45 correct out of 50. These findings suggest that the production of /r/ and the discrimination of /r/ variants are related.

Though it is generally agreed that specific articulatory and discriminatory errors are related, there is no agreement as to which one is the cause of the other. One group of people (Van Riper and Irwin, 1958, Berry and Eisenson, 1956) believes that articulation errors are the result of faulty discrimination and that discrimination training is a pre-requisite for the correct production of the desired sound. For them auditory training is the first step in the correction of defective sounds.

> The child must hear the correct sound as he has never heard it before. He must hear it everywhere speech is spoken, It must ring in his ears, and every agency available must be used to provide this stimulation (van Riper, 1939, p. 142).

It is also possible, however, that the sound discrimination difficulties of children with articulatory defects have resulted from the articulatory errors themselves. Winitz and Bellerose (1962,1963) have theorized that the learning of an incorrect articulatory response may affect subsequent discrimination between the correct sound and the incorrectly learned sound. This hypothesis is in accord with the findings predicated on the s-R theories of acquire distinctiveness and of equivalence of cues (Bollard and Miller, 1950, pp.97-105). According to the former theory the learning of distinctive verbal responses to similar stimuli facilitates subsequent discrimination between the stimuli and according to the latter theory, the learning of the same verbal respectse to two distinctive stimuli impair) subsequent discrimination between the stimuli by giving the two distinctive stimuli a certain learned equivalence According to these two theories, speech sound discrimination would be more difficult after conditions which permit the incorrect learning of a sound than after conditions which permit the correct learning of a sound.

Winitz and Bellerose (1962) reported research which

was designed to study the possibility that sound discrimination difficulties may be & function of specific articulatory errors. Results of their investigation did not give evidence of a significant relationship between children's ability to discriminate /a/ and /ç / and their correct awareness of the different articulatory placements required for the production of these elements. It is important to note that one of the sound units to be discriminated was the non-English and therefore, nonphonemic /ç/. On this basis, the lack of a significant finding does not actually cast doubt on the hypothesis that discrimination of sounds is linked to the feedback from articulatory movements whan the sounds are phonemic and serve in language as signals for a meaning change.

In another investigation Winitz and Bellerose (1963) studied discrimination learning of 200 first and second grade children as a function of several pretraining conditions. The pretraining conditions were so constructed as to permit the correct or incorrect learning of the syllable (Vrou), that is /Vrou/ for /vrou/ and /brou/ for Vrou/. Discrimination learning was significantly impaired following incorrect learning of /Vrou/. There is other evidence to indicate that sound pretraining may be related to sound discrimination. Lots and others (1960) found that the language background of subjects was an important

factor in their identification of stops. Also we know from investigations of Liberman and others (1961, a,b) that phonemic discriminations are categorical that is, subjects will not respond differentially to a range of stimuli within the phoneme boundary, but will respond differentially to small stimulus change between phoneme boundaries.

Liberman and others (1961, a,b) suggest that speech discrimination may reflect the effects of a large amount of learning and may be interpreted as acquired distinctiveness of cues. They have developed a tentative hypothesis about speech perception which is known as the motor theory of speech perception. It is stated as follows (1961, b, p.177):

> We believe that in the course of his long experience with language, a speaker (and listener) learns to connect' speech sounds with their appropriate articulations. In time, these articulatory movements and their sensory feedback (or, more likely, the corresponding neurological processes) become part of the perceiving process mediating between the acoustic stimulus and its ultimate perception.....

Lane (1966) has criticised the motor theory on several grounds. He and his colleagues have provided evidence that would seem to show that the motor theory is an un-necessary assumption for the learning of categorical

perception (eg., phoneme contrasts). In their experiments (Lame 1966, Cross and others, 1966) non-speech stimuli were employed; the results show a relation between labeling and discrimination. The labeling responses were linguistic rather than motor. In a certain way, then, these experiments seem to support that part of motor theory which contends mediators (linguistic abstracts) are at work, since acoustic (and visual) cues that occupy different positions along a single continuum are 'labeled' by essentially discontinuous productions. In another way they do not support the motor theory since non-language stimuli were employed, stimuli which could not be imitated.

Perhaps one way to discover whether or not speech is a special kind of decoder is to find a person who hears but cannot speak. MacNeilage, Rootes and Chase (1967) studied a 17 year old female who had chronic difficulties in swallowing, chewing and speaking, but whose hearing and intelligence were normal. Her inabilities were apparently related to a loss of somesthetic sensation rather than to damage of the systems governing motor activity.

The detailed inventory of the subject's phonemic perception gave data which are consistent with that found for normal subjects.

Lennoberg (1962) has described a case in which learning

to speak was impossible because of a pathological defect 'and yet this did not affect the development of speech comprehension'.

Jakobson (quoted by Horman, 1977) reports the experience that in certain Caucasian Languages he could distinguish their numerous phonemes, without being able, in spite of all his efforts, to produce them himself. He (1956) also cites the case of a one year old boy who recognized and distinguished faultiessly the words 'tata ' and 'kaka' when spoken to him, but consistently said 'tata' instead of 'kaka'.

It remains to be determined whether a change in discrimination performance is pre-requisite to a change in articulation performance. Winitz (1969) takes the point of view that for some children intensive speech sound discrimination training between the error sound and the correct sound will facilitate the subsequent learing of the correct sound.

The importance of speech sound discrimination training as a pre-requisite to sound learning was investigated by Winitz and Preisler (1966). The plan of the study involved.

(a) selecting a phoneme cluster which occurs infrequently in English,

(b) Determining the error children make when trying to produce the cluster,

(c) Training children to discriminate between the error and the correct cluster, and

(d) Assessing the effectiveness of the discrimination training on learning to say the new phoneme cluster. "he /Sr/ cluster was selected as the experimental consonantal cluster.

The general findings of this study indicate that sound discrimination pretraining (between error and correct sound) facilitates the learning of the correct sound. However, it does not seem to assure sound learning, as 5 of the 15 subjects in the experimental group did not evidence learning of the /sr/ cluster. Winitz concludes.

> Thus, it would seem that sound discrimination learning is a necessary but not a sufficient condition for sound learning (p. 279).

But there are others who believe that the ability to produce difference between sounds often comes before the ability to hear these differences. Two groups of experiments may be cited in support of the hypothesis. Remquin and Anderson (quoted by Ladefoged, 1967) tested the ability of Filipino students to pronounse a list of English wards containing contrasting vowel sounds. Scores on these tests were based on judgements of the correctness of pronounciation made by native English

speakers and trained phoneticians. They then compared these scores with tests of the ability of same students to write down a list of the same English words spoken in a different order by a native English speaker. They found that subjects always scored higher in the pronounciation test than in the listening test. They were able to produce differences between pairs of similar vowel Which they were unable to hear consistently.

The second group of experiments which leads to the conclusion has bean reported by Briere (quoted by Ladefoged, 1967). Ha taught a group of American students a number of phonological contracts Which were not in their own speech. He found that there was nearly always a stage at which a subject could produce the new contrast perfectly, but still would not hear the difference. This stage did not last long, however. As soon as the subject became more adept at making the difference, he began to hear it and could make correct identification more consistently.

According to Lodefoged, correct pronounciation can be achieved through the understanding of the articulations involved but it is often achieved by trial and error accompanied by reinforcement for correct responses, and it almost invariably precedes perception. Exception to this

rule are the students learning a foreign language who often distinguish between sounds made by the instructors but do not make these distinctions while producing the sounds. He claims,

> ..... in general, if people can hear a difference between a pair of similar sounds, then they can make the difference - but do not nceessarily do so in their ordinary speech (p. 169).

It needs to be known whether the ability to produce differences between sounds precedes or follows the Ability to perceive these differences. The studies just quoted were done on adult. The same may not hold good in the case of childern.It is generally believed (Ladefoged, personal communication, Berko and Brown, 1960) that children perceive differences between sounds long before they can produce them.

Winitz (1969) suggests that after some point in time (probably by two years of age) speech a sound discrimination scores reflect the speech / sound experience (phoomena system) of children. It is possible that speech sound diserimination tests that are administered to articulatory defective children may reflect primarily the effect of a large amount of faulty speech sound learning.

> .....Thus we art act saying/distinctions that phonemic cannot be learned before articulatory productions are learned only that articulatory experience will affect later discriminations (Winitz, 1969, p.198).

The review suggests that there may be a pattern in the development of speech sound discrimination. It is also known that the development of articulation follows a pattern. But the relationship between the two is not clear.

Hence the present study was taken up to look for patterns in the development of discrimination, and to study the relationship between articulation and diserimination.

Tests of Speech sound Discrimination

The usual speech sound discrimination test consists of a list of words or nonsense syllable pairs. Each pair of items consists of short sequences of phonemes. identical in number. The test items are varied, so that some pairs ctontain the same phonemes and other pairs show a difference of one phoneme. When the pairs differ by one phoneme,the position of the contrasting phoneme is kept constant. The subject is asked whether the items are the same or different.

The sound discrimination test published by Travis and

Rasmus (1931) is made up of 366 pairs of nonsense syllables which are identical or differ from one another in only one phoneme. In 300 pairs the discrimination is made between consonants and in 66 pairs it is made between vowels. The subject listens to the examiner uttering each pair of syllables and indicates on a blank whether he perceived them as the "same" or "different".

Listening to 366 pairs of nonsense syllables and making judgements about each is amonotonous task. The difficulty of making judgements between abstract nonsense syllables restricts the use of the test to the elementary grades and above (Templin, 1957). For young children a technique of measurement using concrete rather than abstract items is imperative if a valid measure is to be Obtained.

Two different disCrimination tests were employed by Mate (1946). The first test consisted of sentences, such as "shoe your food well", which were printed en standard forms with the test word absent. The subjects were to check the blank space if the test word was mispronounced. The attend test consisted of a paired list of word similars and word contrasts.

Mansur first constructed a picture sound discrimination

test in 1950. Instead of nonsense syllables differing in only one sound element the test was made up of pairs of such words which could to pictured. In the administration of the test, both words in the pairs were uttered by the experimenter. The child's task was to identify the stimulus pair of words from among the four pairs of pictures on a single sheet before him. For any stimulus pair,ab, the four pictures were arranged as follows.

ab, bb, ah and ba.

In subsequent revisions by Haroian, Fronovost and Dumbloton (1981) the presentation has been simplified so that the child indicates the pair of words uttered on a card hearing picutre of one like and one unlike pairing of the words, that is, either aa or bb and ab or ba.

These revisions of Mansur's test have also incrreased the number of discriminations. The original test included 30 pictured word pairs. The revision by a group of students as reported by Fronovost and Dumbleton (1953) consists 36 pairs of discrimination words presented in 72 items so that a recognition of similarity and difference is obtained for each pair.

The Wepman Auditory Discrimination Test (1958) consists of 40 word pairs of contrasts and similars. The contrastive elements involve changes in place of articulation, while manner and voicing are kept constant. The contrastive elements include both consonants and vowels.

Costello and Flowers (1963) uaed "filtered speech" test and "binaural summation test". In the 'filtered Speech" test energy below 960 cps was delivered 40 dB above the subject's SRT; in the 'binaural summation" test the distorted signal was presented to the left ear While the right ear received an undistorted signal 5 dB above the SRT for that ear. The stimulus materials consisted of 50 pictures. A corresponding list of 50 monoayllabic words was compiled, each word was either the name of the object in the picture or the name of an object whose name was similar to (a difference of one or two phonemes) the object in the picture. Discrimination was tested by having the subject answer yes or no to the question : "Is this a picture of .....?

It is obvious that very few tests are based on the concept of distinctive features, which has been very useful in studying the development of speech sound discrimination, and which also has therapeutic implications. Since there was no test for discrimination in Kannada, a test had to be developed using the concept of distinctive features.

CHAPTER III

METHODOLOGY

Test Construction

The phonemic inventory of Kannada as given by Somasundaran (in press) was used, with a few modifications, for analyzing the phonemes in terms of distinctive features (Jakobson, Fant and Halle, 1963).

Since no spectrographic analysis could be done, it was assumed that the phonemes of Kannada were similar to the corresponding phonemes of English. Though Kannada has 10 distinctive features, all of them are not 'distinctive'. In the present study, only those features which were distinctive were considered.

Pairs of phonemes differing in one or two distinctive features were chosen out of which a list of 17 minimal pairs waa made up (Appendix d) .

The selection of minimal pairs was restricted owing to two factors :

(i) The words had to be familiar to young children

(ii) Both the members of the pair has to be picturable.

Four pairs of pictures were used to represent each word Pair. For any stimulus word-pair, ab, the four picture-pairs were aa, bb, ab and ba. The picture pairs of each set were pasted oa a sheet of thick paper and enclosed in a transparent plastic case. The arrangements of picture pairs was the same for all the sets.

Recording

The stimulus word pairs were read out by an adult female speaker in a sound treated room and recorded on a Telefunken Taperecorder.

The following instructions preceded the stimulus :

ನೋಡು ಮಗು, ನಾನೀಗ ಕೆಲವು ಪದಗಳ ಹೇಳ್ತಾ ಹೋಗ್ತೀನಿ. ಕೇಳಿಸ್ತಾ. ಎರಡೆರಡು ಪದಗಳ ಒಂದಾದ್ಮೇಲೊಂದು ಹೇಳ್ತೀನಿ. ನಾನೇನು ಪದಾನ ಹೇಳ್ತೀನೋ ಆ ಚಿತ್ರಕ್ಕೆ ನೀನು ತೋರಿಸ್ಬೇಕು. ನೋಡೀಗ, 'ಎಲೆ' 'ಒಲೆ' ಅಂತ್ರಿ ಮಾದಲು ಎಲೆ ತೋರಿಸ್ಬೇಕು ಆಮೇಲೆ ಒಲೆ ತೋರಿಸ್ಬೇಕು ಸೊತ್ತಾಗ್ಲಿ ಇಕ್ರಿ ಕೇಳ್ದು, ತಿಳಿತ ಹೇಳ್ತೀನಿ. ಅರ್ಥ ಆಯ್ತ? ಈಗ ಬುದುಪಲ ಮಾಡೋಣಬೀ?

The English version of the instructions is given below:

> I will go on saying some words) listen carefully. I will say two words one after another. You should point to the picture-pair named by me If I say '/ele/' '/ole/' . point to the /ele/ first and then to the /ole/. If you do not follow please tell me and I will repeat. Did you follow me? Shall we try it now ?

This was followed by a few word pairs whose pictures the child had to paint to.

For each stimulus word pair there were four possible combinations. Instead of reading all of them successively one randomly chosen item from each set was recorded -and this was repeated until all the four items of each set were recorded. There were a gap of 10 seconds between successive word pairs.

Validity

There is no other test for discrimination in Kannada Hence, the performance on the present test could not be compared with that on any other test. However, the test can be presumed to measure discrimination since similar tests for measuring discrimination do exist in English (Pronovest and Dumbleton, 1953).

The test was administered to normal adults same of them committed one or two errors, but these were random and hence, could not be attributed to faulty recording.

Subjects

The subjects comprised 105 school-going Children from various localities in Mysore City. The criteria for

selecting the subjects were:

(i) He/she should between 4 and 8 years of age. The lower limit of 4 years was chosen because it was thought difficult to test pre-school children with this test. The upper limit of 8 years was choaen because mahy investigators (Tamplin, 1967) have shown that phonemic development is complete by the time a child is 8 years old.

(ii) He/she should have normal helping for the speech frequeneies.

(iii) He/She should not have any observable defeat of the speech meachanism.

(iv) He/she should Know Kannada.

Procedure

A random sample was drawn among the children from each of the following grades :

(i) Upper Nursery

(ii) I and II grade

Their hearing was tested in a quiet place in the school. The noise level varied in different schools, tad could not be controlled, but it was low enough to permit normal conversation. Those who did not have normal hearing for the speech frequencies were rejected.

The picture-pairs of the discrimination test were first used to elicit oral responses from the children in

order to ensure familiarity. The careful selection of words did not result in all words being known by all children. However, the fact that a child does not identify the word pictured need not mean that the word is not known to him. It may not be identified because of the particular picture, used to elicit it. When a Child did net name a picture, the experimenter named it and sometimes, whan the picture was ambigous, explained it.

After this, the instructions were played and the child was asked whether he understood them. The instructions were repeated When found necessary. The task was demonstrated to the child and a few trials were given. Tha pictures used for practice were not part of tha discrimination test. The real discrimination task was begun only after ensuring that the child had understood the instructions.

Both the test material and the tape recorder were kept in front of the child. The stimulus word pairs were played at a constant loudness. The child pointed to the picture-pair that he thought was named. Bach response was noted down aa either right or wrong. The child was periodically reinforced verbally after correct responses. The child was also occasionally reminded to

After the administration of the discrimination test, the child's oral responses to the same pictures were taped. Also, a picture-word articulation test was adminiatered to elicit all the phonemes of Kannada, some of which were not included in the discrimination test. The purpose was to see whether a speech sound and/or distinctive feature was consistently misarticulated, and to correlate articulation with discrimination.

While recording the child's oral responses to pictures he/she uttered the words spontaneously, or occasionally, repeated the words after the examiner. Templin (1947) has reported that similar results are obtained in the measure-ment of speech sound articulation of normal children whether a repeated or a spontaneous utterance is used.

Reliability

Some of the children (N = 26) were retested after an interval which varied from a few hours to 2 days for different children. The pearson product moment correlation was used as the measure of reliability. The performances of all the children on the two occasions were compared for each item. The correlations ranged form 0.60 to 1.00 for different word pairs which were statistically significant at 0.01 level.

Analysis

Two Speech and Hearing graduates were chosen to judge the recorded speech samples. Each response was assigned to one of the following categories-correct, emitted, mildly distorted, severely distorted and substituted. The two listeners evaluated the samples independently. There was close agreement between the two judges except at some points which were not relevant for the present study. For example, in evaluating the articulation of word pairs, only those sounds which were in contrast were of concern.

CHAPTBR IV

RESULTS & DISCUSSION

The score sheet used for evaluating discrimination is shown in the appendix II. Bach correct response was counted as one and an incorrect response as zero. Accordingly, the minimum and maximum scores for each item were 0 and 4 respectively.

The children were grouped on the basis of their age There were eleven groups, in seven of which the range was six months. It was not thought necessary to have such a small range after the age of 8 years. The number of children in each group was not equal and ranged from 3 to 23. No effort was made to control it as it was dependent upon the availability of children.

Table 1. shows the number of children in each group who correctly discriminated each item. A score of 3 or 4 was the criterion for correct discrimination. Since the number of children in each group was not the same, this was converted to percentage of children in each group who correctly discriminated each item (Table 3).

The following observations were made regarding the speech sound discrimination of children :

(1) The feature of nasality was discriminated better than all the other features. Except

for one or two children in each group, all the other children, even in the youngest age-group studied discriminated this feature correctly.

(ii) The feature of voicing was easily discriminated by more than 76% of the children 5 1/2 years and older.

(iii) Word pairs which differed in more than one distinctive feature were discriminated better than these which differed in only one distinctive feature at all ago levels.

(iv) Vowels were discriminated better than consonants differing in features other than voicing or nasality.

(v) Vowels differing in the grave-acute dimension were discriminated better than those differing in the compact-diffuse dimension.

(vi) The same feature was not discriminated equally well in all the word pairs.

(vii) Geminate consonants were discriminated betrter than single consonants.

(viii) The sounds /d/ and /d/ were discriminated better when they were preceded and followed by a front vowel than by a back vowel.

(ix) The distinction between /l/ aad /l/ was the last to be acquired.

(x) The development of discrimination was complete by the age of 8 years. These results led to the acceptance of the hypothesis that there is a pattern in the development of speech sound discrimination.

TABLE 1

Showing the number of children in each age group who correctly each item

Age group	N	Items 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3.8-4.1	3	3	3	0	1	0	3	0	3	3	1	0	0	1	1	0	2	1
4.7-5	5	3	4	1	2	4	6	1	2	4	3	4	0	2	3	2	6	4
5.1-5.6	7	5	6	1	1	4		1	3	0	1	2	1	1	2	3	7	3
5.7-6	15	13	14	0	11	13	14	10	13	14	8	12	3	6	10	9	14	14
6.1-6.6	20	19	19	9	16	15	20	12	16	20	12	16	6	10	16	13	20	16
	23	21	21	13	16	20	22	13	18	31	18	14	6	10	16	11	21	16
7.1-7.6	12	12	12	7	9	11	11	6	11	10	6	9	2	6	11	6	18	11
7.7-8	6	5	6	5	4	6	6	6	6	6	4	4	4	3	4	4	6	3
8-9	7	6	6	5	6	7	7	6	6	6	6	6	7	5	6	6	6	7
9-11	3	3	3	3	-3	3	3	3	3	3	3	3	2	3	3	3	3	3
11+	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

TABLE 2

Reading the percentage of children in each age group who correctly discriminated each item

Items Age Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3.8-4.1	100	100	0	0	33	100	0	100	100	33	0	0	33	33	0	66	33
4.7-5	60	80	20	*0	80	100	20	40	80	60	80	0	20	40	40	100	80
5.1-5.6	71	71	14	14	57	100		43	71	14	29	14	14	29	43	100	43
5.7-6	87	94	60	74	87	94	67	87	80	54	80	20	40	67	60	94	94
6.1-6.6	95	95	45	80	76	100	60	80	100	60	75	30	50	80	65	100	76
6.7-7	90	90	66	77	86	95	56	77	90	77	60	34	43	69	47	90	65
7.1-7-5	100	100	68	76	91	91	42	91	83	60	75	18	60	91	42	100	91
7.7-8	84	100	84	67	100	100	84	100	100	67	67	67	60	67	67	100	50
8-9	86	86	71	86	100	100	86	86	86	86	86	100	71	86	86	86	100
9-11	100	100,	100	100	100	100	100	100	100	100	100	67	100	100	100	100	100
11+	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

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Discussion

Observations 1 and 2 are in Agreement with the findings of Miller & Nicely (1965) who observed that it was easier to dsicriminate between two sounds which differed in manner of articulation (voicing, nasality) than those which differed in place of articulation. Koenigaknecht & Lee (1968) also obtained similar results. They also support Jakobson's hypothesis that the opposition of nasal and oral consonants belongs to the earliest acquisitions of the child.

Observation 3 supports the proposition of Jakobson & Ralle (1956) that physical stimuli that are most distinctive are learned first with finer differentiations following later.

It is Will known that consonants are modified by the preceding and the following vowels. Hence there was no consistency in discrimination in terms of features. The same sounds were more discriminative in particular phonetic contents than in others.

The present study also confirms Menyuk's observations that diatinctions among members of certain sets (liquids & Stridents) are late acquisitions. However, Menyuk's data relates to speech sound productions and not to perception.

It in interesting to note that distinctions that are acquired late are also perceived late.

Examination of Table 2 reveals that sometimes younger children performed better than older children. This was because one or two children in the older group consistently failed to discriminate, and since N was small, the percentage dropped considerably.

Though the word pairs differed in different features, a hierarchy of case of discrimination of features could not be made because factors like position of the contrasting element in the word, and phonetic context were not controlled.

Discrimination in relation to articulation

The articulatory performance of children was evaluated by two trained listeners. The sounds misarticulated by each child and the type of misarticulation were noted down. In case of substitutions the substituted sounds were noted down. The discrimination and articulation of each child for each item were then compared. Theoretically, there are four possibilities Correct articulation and discrimination, impaired articulation and discrimination, impaired disrimination with correct articulation, and correct discrimination with misarticulation.

Tables 3 and 4 show the relationship between articulation and discrimination for each group for each word pair. The following observations regarding the relationship between articulation and discrimination were made :

(i) Cross distinctions involving a difference of more than one distinctive feature were made both in articulation and discrimination even by the youngest group studied.

(ii) The oral-nasal distinction was produced correctly by all the children. Only 10 children made errors on this feature in discrimination.

(iii) Only one child did not make the voiced-voiceless differentiation while in discrimination, there were 44 errors on item No. 7 and 22 on item No. 8. The errors were infrequent after the age of 7 years.

(iv) Vowels were never misarticulated. The errors in discrimination decreased with ago.

TABLE 4

Showing the relationship between articulation and discrimination

Age-groups	7.1-7.6 (N=12)				7.7 - 8 (N-6)				8 - 9 (N=7)				9 - 11 (N=3)				11 + (N = 4)			
Items	++	--	+-	–+	++	--	+-	-+	++	--	+-	-+	++	--	+-	-+	++	-–	+-	-+
1	11		1		6				6		1		3				4			
2	12				6				8		1		3				4			
3	5		7		6				8		2		3				4			
4	8		4		6		1				1		3				4			
5	11		1		6				7				3				4			
6	11		1		6				7				3				4			
7	4		8		6				8		1		3				4			
8	11		1		6				8		1		3				4			
9	10		2		6				8		1		3				4			
10	5		7		5		1		8		1		3				4			
11	9		3		4		2		8		1		3				4			
12	1	2	9		4		2		7				2				4			
13	5	2	5		4		2		8		2		3				4			
14	10		2		5		1		8		1		3				4			
15	4		7	1	5		1		8		1		3				4			
16					6				8		1		3				4			
17			1	1	4		2		7				3				4			

++ .. Correct articulation and discrimination
-- .. Misarticulation with impaired discrimination

+- .. Correct articulation with impaired discrimination
-+ .. Misarticulation with correct discrimination

TABLE 3

Showing the relationship between articulation and Discrimination

Age-Groups	3.8-4-1(N=34)		4.7-5(N-4)		5.1-5.6(N-7)		5.7-6(N=15)		6.1-6667(N=20-23)			
Items	++	+-/-+	++	--	++	--	++	-+/++	+-	-+/++/+-	--	
1	3		3	1		4	3	13	2	19	1	21	2
2	3		4			5	2	13	2	19	1	21	2
3	3		1	3		1	6	8	7	9	11	12	11
4	1	3	2	2		1	6	11	4	14	6	18	8
5		2	3	1		4	3	13	2	15	5	20	3
6	3	3	4			7		14	1	20		22	1
7		3	1	3		1	6	10	4	12	8	12	11
8	3		1	3		3	4	13 1	1	16	4	18	6
9	3		1	1		5	2	13 1	2	20		21	2
10		2	3	3		1 1	5	8	7	12 1	7	17	6
11		1 2	2	2	1	1 1	5	12 2	3	16 1	4	14 2	7
12		1 2	3		1	1 1	5	3	10	5 3	12	8 3	12
13	1	1 1		3	1	1 1	5	6 3	6	10 2	8	10 4	9
14	1	2	1	3	2	1 1	4	10 1	4	16	4	16	7
15	2	3	2	2	2	1 1	3	9	6	13	7		12
16	1	1	2	2	3			14 1	1	20		22	1
17			4		7			12	2	16	1	15 1	7
			3	l	3	4							

++ .. correct articulation and discrimination
-- .. Misarticuiation with impaired discrimination
+- .. correct articulation impaired discrimination
-+ .. Misarticuiation with correct discrimination

Table 5 shows the average error on items 4 and 5 (compact Vs Diffuse) for the different age-groups.

Table 5

Age Group	N	Errors Average
3.8 - 4.1	3	2.5
4.7-5	4	1.5
6.1-5.6	7	
6.7-6	15	3
6.1-6.6	20	4.5
6.7-7	23	3
7.1-7.6	12	2.5
7.7-8	6	0.5
8-9	7	0.5
9-11	3	0
11	4	0

(V) The number of children who had acquired the different distinctions both in perception and production increased with age. There were no misarticulations beyond the age of 71/2 years. Except in two instances all the sounds misarticulated were retroflex sounds. Among the retroflex sounds, the liquid /l/ was the last to be acquired both in articulation and in discrimination.

(vi) Except in four instances, all the sounds misarticulated were also misperceived. In one instance, the child either omitted or substituted /w/ for /r/. The discrimination task required the child to distinguish

between /r/ and /l/, which the child did with no difficulty. In the other three instances the misarticulations were inconsistent, and the desired sound was uttered in other contexts.

(vii) On the other hand, all the word pairs which were articulated correctly were not discriminated. The distinction most consistently missed was that between alveolar and retroflex sounds.

Table 6 shows the No. of errors on this feature far the different age groups.

Table 6

Age group	N	Errors
3.8-4.1	3	14
4.7-5	4	12
6.1-6.6	7	31
6.7-6	15	39
6.1-6.6	20	47
6.7-7	23	60
7.1-7.6	12	34
7.7-8	6	11
8-9	7	6
9-11	3	1
11+	4	0

(vii) There were also many errors on item No. 3 which had the contrasting element in a blend. Table 7 shows the No. of errors on this item at different age levels.

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Table 7

Age groups	N	Errors
3.8 - 4.1	3	3
4.7-6	4	3
6.1 - 6.6	7	6
5.7-6	15	7
3.1-6.6	20	11
6.7 - 7	23	11
7.1 - 7.6	12	7
7.7 - 8	6	0
8 - 9	7	2
9-11	8	0
11+	4	0

These results did not support the null hypothesis that there is no relation between articulation and dsi-crimination, and was hence rejected.

The group of children with correct articulation and impaired discrimination is of particular interest because, contrary to the popular belief, it shows that the production of a distinction precedes its perception. This finding supports the motor theory of speech perception

propounded by Liberman and his colleagues (1961,b) It also casts doubt on the role of auditory training in the correction of miscrticulation. The possibility that sound discrimination learing is a function of feedback from sound production indicates that the so-called ear-listning activities which concentrate on differential listaning may be ineggicient as a means to proper articu-lation.On the other hand it may be more production to allow auditory discrimination to develop as a function of verbal out-put.

CHAPTER V

SUMMARY AND CONCLUSIONS

Little is known about the relationship between articulation and discrimination in phonological development. Winitz (1969) has suggested that the child's understanding of the adult phoneme system or a portion thereof, antedates any attempt by him to utter language units.

In the absence of unequivocal evidence, many have assumed that articulatory errors reflect impairment in the development of speech sound discrimination. To test this hypothesis, the relationship between articulatory performance, and discrimination has bean investigated. Articulatory defectives have been found to be inferior to articulatory non-defectives on tests of discrimination.

Since the apticulatory defectives have been studied as a group, the relationship between specific articulatory and discrimination errors is not clear.

Since there was no test for discrimination in Kannada, a test using distinctive features was developed. The purpose of the study was -

(i) To look for patterns in the development of discrimination, and

(ii) To study the relationship between articulation and discrimination.

It was hypothesized that :

(i) There is a pattern in the development of speech sound discrimination, and

(ii) There is no relationship between articulation and discrimination.

A list ef 17 minimal pairs was made up by using pairs of sounds which differed in one or two distinctive features. Four pairs of pictures illustrated each item. The instructions and stimulus word pairs were recorded.

The test was administered to a random sample of school-going children in various localities of Mysore City. All the children had normal hearing. The discrimination test required the child to point to the picture-pair from among four pairs illustrating the word pair ha heard. A score of 3 or 4 was the criterion for correct discrimination.

The child's oral responses to these picture pairs, tad, to a picture word articulation test were taped, and evaluated by two trained speech and hearing graduates. The discriminations and articulation of aaah item were then compared.

There was a definite pattern in the development of discrimination, supporting Jakobaon's hypothesis. Words differing more than one distinctive feature were discriminated better than those differing in one discrimation feature. Features of voicing and nasality Were distinguished at an earlier age than features of place. Thus the hypothesis that there is a pattern in the development of discrimination was retained. The present study also supported earlier observations that distinctions between members of certain sets (liquids and stridents) were the last to be acquired. All the distinctions had been acquired by the age of 8 years.

The following dbservations regarding the relationship between articulation and discrimination were made

(i) Sounds that were discriminated correctly were also articulated correctly.

(ii) Except in 4 instances, sounds that were misarticulated were also not discriminated.

(iii) on the other hand, many word pairs which were articulated correctly were not discriminated. Errors in discrimination persisted for sometime after the distinction had been made in articulation.

The distinction between alveolar and retroflex sounds was the last to be Acquired both in perception and in production.

The production of a distinction always preceded its perception. This was interpreted as supporting the motor

theory of speech perception (Liberman et al, 1961 , b). The importance of ear-training in the correction of mis-articulation was questioned.

Limitation

The sample of the present study was too small to draw conclusions of any generality.

Recommendations for further research

1. A similar study may be carried out in other Indian languages using a large sample to verify jakobson's hypothesis.

2. Bilingual children may be studied to see if the patterns of acquisition are the same for both the language.

3. The relationship between the acquisition of phonamic distinctions by children, and the order in which these distinctions are restored in aphasics, may also be studied.

BIBLIOGRAPHY

Anderson, P.W. ; The relationship of normal and defective articulation of the consonant (S) in various phonetic contexts to auditory discrimination between normal and defective (s) productions among children from Kindergarten through fourth grade. M.A., Thesis, Univ. Iowa, 19*9. quoted by spriestersbach, D.C., and Curtis, J.P., in "Misarticulation and Discrimination of Speech Sounds". Quart, J. speech, 37, 1961 , p.483-491.

Avngst, L.F, and Prick, J.V.: Auditory Discrimination ability and consistency of articulation of /r/ JSHD, 1964, 89, 76-84.

Berko, J, and Brown, R. : Psycholingulstle Research Methods In P.H. Mussen (Ed), Hand book of research methods in child Development. New York, Wiley 1969.

Berry, M.F. & Eisenson, J. : speech Disorders : Principles and practices of Therapy. London: peter Oven Ltd., 1956.

Briene, E.J. : An experimental approach to defining a hierarchy of difficulties of learning phonological categories. Quoted by Ladefoged (1967).

Clark, R.M. ; Maturation and Speech development, Part I Logos, 1969, 2, 49-54. quoted by winitz,1969.

Cohen, J.H, and Diehl, C.F. Relation of Speech Sound Discrimination Ability to Articulation - type speech Defects. JSHD, 1963, (63) 28, 187-190.

Costello, M.R. & Flowers, A. : Responses to distorted speech of Children with severe Articulation Disorders Journal of Auditory Research, 1963, 3, 133-139. quoted by Winitz, 1969.

Cross, D.V. and Lane, H, and sheppard, w : Identification and Discrimination. Functions for a visual costinuity and their relation to the motor theory of speech perception. J. of expt. Psy. 1966, 70, 63-74.

Bollard, J, and Miller, N.E.: Personality and Psychotherapy An Analysis in terms of learning, thinking and culture. New York : McGraw-Hill, 1950.

Flower, et al : The communicative Disorders of Children with Kernieteric Athetosis ; Auditory Disorders, JSHD 1966,31,41-69.

Goldiamond, I : perception in Bachrach, A. (Ed) Experimental Foundations of Clinical Psychology. New York : Basic Books, Inc. 1963.

Hall. M.E., : Auditory Factors in Functional Articulatory Speech Defects. Journal of Experimental Education, 1938, 7, 110-132. Quoted by winltz, 1969.

Haneen, B.P. : The application of sound discrimination tests to functional articulatory defectives with normal hearing. J.S.D. 1944, 9, 347-

Haroian, Rose D ; preliminary validation of Manaur's Speech Sound discrimination test in the Kindergarten and first grade.unpublished M.Ed. thesis, Boston university, 1961. quoted by Teaplin (1957).

Herman, H : Psycholinguiatles : An Introduction to Research and Theory. Springer - Verlag, Berlin. Heidelberg, 1971.

Jakobson, R : Child Language, Aphasia and phonological universals. The Hague : Mouton & co.; 1968.

Jakobson, R and Halle, M : Fundamentals of Language. The Hague : Mouton & Co., 1966.

Jakobson, R, C. Gunnar M Fant, Morris Halls. Preliminaries to speech analysis. The Distinctive features and their correlates. The MIT Press, Cambridge, Massachussets, 1969 (8th printing).

Koenigsknecht, R.A. & Dee, L.L. 1968. Distinctive features analysis of Speech sound Discrimination in 3 year old children, paper presented at the ASHA, Denver Colo, Quoted by Menyuk (1971).

Kronvall, E.L, and Diehl C.F. ; The relationship of auditory discrimination to articulation defects of children with no known organic impairment JSHD, 1954, 19, p. 335-338.

Ladefoged, P : Three areas of experimental phonetics Oxford university Press, 1967.

Lass, H: The actor theory of speech perception. A Critical review. psychological Review, 1966, 72, 276-309.

Leneberg, E:Understanding language without ability to speak A Case Report. J. abnorm, soe. psychol, 1962

Liberman, A.M. et a1 :The discrimination of speech Sounds within and across phoneme boundaries. Journal of experimental psychology, 1967, 54, 358-368.

Liberman, A.H. et al : An Effect of Learning on Speech Perception : The Discrimination of durations of silence With and without significance. Language and Speech 1961 (a) 4, 176 - 196.

Lotz, J, et al : The Perception of English Stops by speakers of English, Spanish, Hungarian and that : 4 tape tutting experiment. Language and Speech, 1960. 3, 71. Quoted by winitz, 1969.

Mcneilage,F.F.Rootes, T.P. and Chase, R.A. : Speech Production and Perception in a patient with severe impairment of somesthetic perception and motor control. JSHR, 1967, 10, 449-467.

Mansur, W : The Construction of a picture Test for Speech Sound Discrimination, unpublished M.A. Thesis Boston University, 1960. Quoted by Tomplin,M.C in "Certain Language skills in Children. The Univeraity of Minnesota press, Minneapolis,1957.

Menyuk, p : The Role of Distinctive Features in Children's Acquisition of Phonology. JSHR, 1968, 11,138-46

Menyuk, p and Anderson : children's Identification and Reproduction of /w/, /r/ and /1/. JSHR, 1969 12, 39-68.

Menyuk, p : The Acquisition and Development of Language prentice Hall, Inc., Englewood Cliffs, 1971.

Mase, D.J : Etiology of Articulatory Speech Defects. Teachers' College contribution to Education No. 921 New York : Columbia University, 1946 quoted by Winits (1969).

Mowrer, D.E, Baker, R.L. and schutz, R.E. : Operant procedures in the control of speech articulatlom$ In sloans and Macqulay (Eds). Operant procedures and remedial speech and language training. Houghton Mifflin Company, Boston, 1968.

Prins, D. Relations among specific articulation deviations and responses to a clinical measure of sound discrimination ability. JSHD, 1963, 28,382-388.

Pronovost, W, and Dumbleton, C : A Picture type speech sound discrimination test. JSHD, 1953, 18,268-266.

Held, 0 : The Etiology and Nature of Functional Articulatory defects in Elementary School Children. JSD, 1947.18 143-150.

Schieflbusch, R.L. and Lindsey, M.J : A New Test of Sound Discrimination. JSHD, 1958, 23, 153-159.

Sherman, D and Geith, A : Speech sound Discrimination and Articulation Skill. JSHR, 1967, 10, 277-280.

Somasundaran, n (in press) A Contrastive phonology of Tamil Telugu, Kannada and Malayalam based on Distinctive features.

Stewart. A : Disorders of Articulation in Children, BJDC 1968, 3, 121-129.

Templin, M.C. :spontaneous Vs Imitated Vorbalisation in Testing Articulation in Pre-school Children JSHD, 1947, 12, 393-300.

Templin, M.C. : Certain Language skills in children. The university of Minnesota Press, Minneapolis.

Travis, L.E. and Rasmus, B : The speech sound Discrimination Ability of Cases with Functional Disorders of Articulation. quarterly Journal of Speech, 1931, 17, 217-226. quoted by Winits, 1969.

Van Riper, C : Speech Correction ; Principles and Method Englewood Cliffs, Prentice Hall 1954.

Van Riper C, and Irwin, J.V. : Voice and Articulation. Englewood Cliffs. Printice Hall, Inc, 1958.

Van Riper. C : Ear Training in the Treatment of Articulation Disorders - JSD, 1939,4. p. 141-142.

Weiner, P.S. : Auditory Discrimination and Articulation. JSHD, 1967, 32, 19-28.

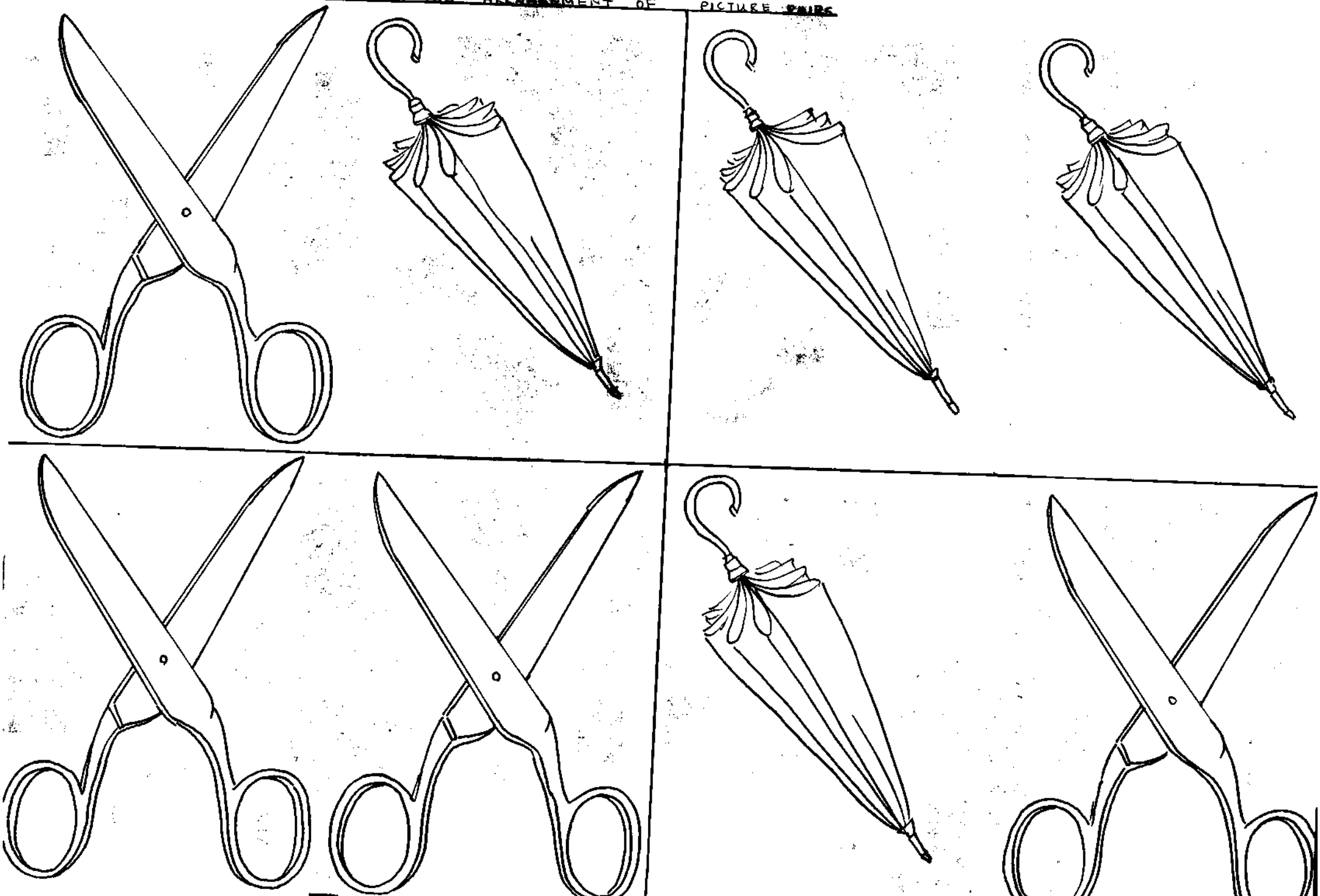
Wepman, J.M. : Auditory Discrimination Test : Manual of Direction.. Chicago: Language Research Associates, 1958. quoted by Winits (1969)

Winitz , H and Bellerose, B : Sound Discrimination as Function of pre-training conditions. JSHR, 1962 5, 340-345.

A P P E N D I X

APPENDIX - 1

FIG. SHOWING THE ARRANGEMENT OF PICTURE PAIRS



APPENDIX - 2

DISCRIMINATION TASK

Child's name _____ Sex _____

Birth data _____ Age Yrs Mths____

Items	Trials I	II	III	IV
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				

APPENDIX - 3

LIST OF WORDPAIRS USED IN THE DISCRIMINATION TASK

ಬೀಗ	ಬೀಜ
ದಡ	ಜಡ
ದಪ್ಪ	ಜಪ್ಪ
ಓದು	ಯಾದು
ಇಪ್ಪತ್ತು	ಎಪ್ಪತ್ತು
ಕತ್ತಿ	ಕತ್ತಿ
ಕಮಾಡು	ಗಮಾಡು
ಪೆಸರು	ಪೈಸರು
[illegible]	ಹುಳಿ
ಕತ್ತು	ಕಣ್ಣು
ಕಾಲು	ಕಾಳು
[illegible]	ಆಳ
[illegible]	ಹಂಪ
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	ಒಳ
ಕಾಲು	ಕಾರು