ARTICULATION FUNCTIONS FOR THE COMMON WORD LISTS BETWEEN KANNADA AND TELUGU LANGUAGES FOR NATIVE SPEAKERS OF TELUGU

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A Dissertation
submitted in part fulfilment of the Degree
of Master of Science (Speech and Hearing)

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Dedicated to My

PARENTS AND TEACHERS

C E R T I F I C A T E

This is to certify that the dissertation entitled "ARTICULATION FUNCTION FOR THE COMMON WORD LISTS BETWEEN KANNADA AND TELUGU LANGUAGES FOR NATIVE SPEAKERS OF TELUGU" is the bonafide work in part fulfilment of the Degree of Master of Science (Speech and Hearing) of the student with Register No.

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C E R T I F I C A T E

This is to certify that the dissertation entitled "ARTICULATION FUNCTION FOR THE COMMON WORD LISTS BETWEEN KANNADA AND TELUGU LANGUAGES FOR NATIVE SPEAKERS OF TELUGU" has been done under my supervision and guidance.

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DECLARATION

This dissertation is the result of my own work done under the guidance of Dr. (Miss) Shailaja Nikam, Professor & Head of the Department of Audiology, 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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A C K N O W L E D G E M E N T

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CONTENTS

C H A P T E R - I

INTRODUCTION

The speech stimuli have come to occupy an important place among the auditory stimuli that are used in clinical audiometry. By measuring a patient's ability to use his hearing in ways that are closer to everyday auditory experience. Speech audiometry has not only added a kind of validity to pure tone audiometry, but also has appeared to have diagnostic end prognostic value as well. (Hirsh et al, 1971).

Speech audiometry includes the clinical procedures used in measuring auditory response to speech stimuli. Speech reception threshold and speech discrimination are the stimulus dimensions assessed most frequently in clinical practice (Chaiklin, 1971).

The speech reception threshold is defined as the minimum hearing level at which the patient can repeat correctly atleast fifty percent of the speech stimuli. (Hopkinson, 1978). Whereas the function of the speech discrimination test is to find the listener's capacity to discriminate speech sounds at a level above his threshold.

Pathologies in the retrocochlear region end higher auditory pathways may not result in loss of hearing for puretones, despite

significant difficulty in speech discrimination (Goetzinger, 1972, Hodgson, 1972). Tests for speech discrimination abilities can be used to obtain performance intensity functions, which are useful in the diagnosis of VIII nerve lesions. (Jerger & Jerger, 1971; Jerger & Hayes 1977).

Speech discrimination tasting is thus an important tool in clinical audiology.

Need for the study:

Various types of material have been developed to determine a subject's ability to discriminate speech. In India, multiplicity of languages and varieties of dialects have offered great obstacle in the evolution of common speech material for audiometric tests.

English tests standardized to the Indian population (Swarnatha 1972, Malini, 1981) have limited clinical applicability. Speech test materials in all Indian languages are not available. Attempts have been made to develop and standardize speech discrimination tasks in some of the Indian languages as a result of which we have discrimination tests in Hindi (De, 1973), Tamil discrimination test (Samuel, 1976), Malayalam and Telugu (Kapur, 1973), SDT in Gujarathi (Mallikarjuna, 1984).

The Telugu discrimination test developed by Kapur (1973) has not been standardized. In Kannada language, except SSI (Nagaraja, 1973) no standardized discrimination test is available. An attempt was made to construct common word lists between Kannada and Telugu. It was found that both native Telugu speakers and native Kannada speakers recognized these words as belonging to their language (Srilatha, 1983).

The present study was designed to answer the following questions*

(1) Does the discrimination score increase with increase in sensation level for these common word lists?

(2) Are the four lists equivalent?

(3) Do the two carrier phrases differently affect the discrimination scores?

(4) Is there an interaction effect between sensation level and carrier phrase?

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C H A P T E R - II

REVIEW OF LITERATURE

Speech is an act of communication and is uniquely human. Of the special human senses hearing is primary for speech development. A direct measure of this auditory acuity is done by pure tone audiometry. But, "hearing of pure tones constitutes a very small end insignificant part of the ordinary auditory experiences of most individuals. Its measurement is too limited to describe the individual's ability to understand the speech of his fellow communicators" (Hirsh, 1965).

This is achieved through speech audiometry which helps one to measure auditory sensitivity and ability to discriminate speech sounds at a level above threshold.

Speech discrimination tests cover a wide range of difficulty which may be dependent upon the test material as well as the type of test. The material used range from isolated phonemes at one extreme, to nonsense syllables followed by monosyllabic words, words of two syllables or more and sentence at the other extreme. Since nonsense syllables are devoid of meaning, they provide no semantic cues to assist in discrimination. Monosyllabic words on the other hand are meaningful linguistic units of speech and are better discriminated than

nonsense syllables. When they are embedded in sentence they are more discrimineable, because of increased cue provided by the context. Words of two syllables or more afford more cues for discrimination than monosyllabic words. Finally sentences are easier to discriminate than words.

Using different speech stimuli many discrimination tests have been constructed. The clinical applicability of a discrimination test depends upon the standardization of the test to a given population. Available English discrimination tests for English speaking population are;

PAL PB Word Lists: These lists were developed at the Harvard Psychoacoustic Laboratories* They consist of familiar monosyllabic words (Egan, 1948). Twenty lists of 50 words each were constructed out of which eight lists were recorded by Rush Hughes at Central Institute for the Deaf (CID).

Hirsh et al (1952) found a few drawbacks in Rush Hughes recorded lists such as many test words were not familiar and poor standardization.

CIO W-22 word lists: These lists were a modificationof PAL PB-50 lists which was done by Hirsh et al (1952) to over come the limitations of PAL PB-50 lists. Four phonetically balanced words lists of fifty

words each were developed. The carrier phrase used was "You will say....." and the 1000 cps calibration tone was also recorded at the average level of the carrier phrases.

However, there were some drawbacks with CID W-22 lists also. The test was not difficult enough to differentiate mixed loss from pure conduction loss (Hirsh et al 1952). The words were too easy for fine differential diagnosis (Berger 1978). Thus they are inadequate as a diagnostic tool in the cases of mild losses and progressive losses (Geffner and Danovan 1974).

NU Auditory Test Lists 4 and 6: Lehiste and Peterson (1959) developed a monosyllabic word test. The words are of consonant-nucleus-consonant type and ten lists of fifty words each were constructed.

Using these words Tillman, Carhart and Wilber (1963) developed the North Western University (NU) Auditory test No.4. It consists of two lists of fifty words each recorded by a male talker.

In addition to the two lists of the NU Auditory test No.4 two more lists of fifty words were constructed. The four lists together formed NU Auditory Test No.6.

This test is used clinically for the differential diagnosis of hearing loss.

Children's Lists: The above mentioned monosyllabic tests were developed for adults and Haskins (1949) developed four PB word lists for children. The words selected were within the speaking vocabularies of young children. It is called as PBK lists. This is used to test the discrimination ability of young children clinically.

The tests reviewed above require the subjects to choose their response from an open set, the following test involve a closed response set.

Rhyme Tests: Fairbanks rhyme test consisted of fifty sets of five rhyming words which vary only in terms of the initial consonant. Eighteen consonants are incorporated in the test. The subject is required to report the word he has heard by choosing one word from a set of five rhyming words (Fairbanks, 1958).

House et al (1963) modified Fairbanks rhyme test known as "Modified Rhyme Test". This consist@ of six equivalent lists of fifty words each. This test, unlike Fairbank's test, discrimination of the sound in initial as well as in the final position is tested.

KSU Test:- This test employes monosyllabic words, but embedded in sentences (Berger, 1969). The test consists of 150 sentences. Each sentence contains a key word which is so chosen that four other words could also be used in its place, retaining the meaningfulness of the

sentence. The subject has to choose one of these five sentences, which he thinks he has heard.

Synthetic Sentence Identification:- The use of synthetic sentences to assess the discrimination ability was suggested, to overcome the disadvantage of the monosyllabic tests (Jerger, Speaks and Trammell 1968). These sentences ere constructed from a set of 1000 familiar words. They simulate the "real" sentences in that they are long enough to retain the temporal characteristics of speech. At the same time they have an advantage of being non-redundant unlike "real sentences".

The SSI test material is often presented with competing speech of the same talker who has recorded the material. The message to compelition ratio (MCR) used for clinical purposes is 0 dB.

English Discrimination Testa in India:

Research was done on "Adaptation of speech test material in English to Indian condition by Nikam (1968). The words from W-22 and the children's spondee list were combined avoiding repetitions. Eighty words were obtained and subjected to familiarity rating. Out of the eighty words, forty five words were rated as very familiar by 70% of the subjects. These words were intended to be used with those cases with a minimum of high school education.

There have been other attempts at standardizing English tests to Indian population. They are discussed below.

Swarnalatha (1972) developed PB word lists for children and adults. There were four monosyllabic word lists which were phonetically balanced, two lists of equal familiarity for adults and two lists of equal familiarity for children.

Recording was done by a female talker, with the carrier phrase "say the word" preceding every word. Interstimulus time interval was five seconds.

The lists were presented to 56 adults and 56 children at various intensities and articulation curves were plotted. 100 per cent correct articulation score was obtained at 42 dB SL in case of adults and 45 dB SL in case of children.

However, the list consisted of twentyfive words, each word was given a weightage of 4%. Therefore, each error was penalized twice as much as it would have been, if the list had contained fifty words. Another problem is while determining performance-intensity functions, the same lists have to be used repeatedly which could bring in practice effect.

Sood (1981) undertook another study to evaluate the performance of young adults on time compressed speech discrimination.

The two aspects considered for the study were:

(1) to study the performance of young adults on the time-compressed speech discrimination task; and

(2) to study the influence of foreign accent on the performance in order to see if the test can be used in the Indian set up.

The speech stimuli used were the four lists of Form B of NU Auditory Test No.6 (Tillman and Carhart, 1966) each list consisting of fifty meaningful monosyllabic CNC words.

Sood (1981) observed that performance decreased at higher time compression ratios and increased with increase in SL. Time-compression and SL interaction was not observed.

Malini (1981) worked on standardizing the NU Auditory Test No.6 on an English speaking Indian population. The study was aimed at evaluating the applicability of NU Auditory test No.6 for English speaking Indians. The four lists of Form A were recorded by a male, non-native speaker of English (an Indian). The carrier phrase used was "you will say....." and interstimulies interval was 8 seconds.

These recorded lists were presented to forty young adults at five sensation levels, 8, 12, 24, 32 and 40 dBSL (ref: SRT). The results indicated that, discrimination scores improved with an increase in SL. But the scores did not reach the asymptotic level even at 40 dB SL for normal hearing non-native speakers of English.

The relative difficulty of the four lists were similar to that of the native speakers of English.

In 1983, a series of studies were done using recorded NU Auditory test No.6 to evaluate the effect of factors such as familiarity, talker difference, training and age on discrimination scores.

The study of the effect of talker difference on word discrimination scores (Joseph, 1983). It was conducted to see if any significant talker difference existed between the male and female talkers for the recorded versions of the NU Auditory Test No.6. The subjects were forty young adult native speakers of Kannada with normal hearing. Their knowledge of English was assessed by the English test constructed at the Central Institute of English and Foreign Languages, Hyderabad, India.

Results showed that, for the female talker the scores did not show a plateau at 40 dB SL (ref; SRT), which indicated that further improvement in scores could be possible with increase in SLs. But the articulation function curves for male talkers did not show such increase in SL from 32 dB to 40 dB SL (ref* SRT). The scores obtained with the female talker were better than that obtained for the male talker. Hence talker difference was seen to affect the discrimination scores.

Devaraj (1983) took up a study to examine the effect of familiarity of test words (NU Auditory Test No.6) had on the speech

discrimination scores of listeners and also to investigate how familiar the trained and untrained testers found the same word lists.

Two groups of subjects were tested, twenty listeners and forty testers of whom twenty were trained testers and twenty were untrained testers.

The results indicated that, there was a correlation between a listener's familiarity of the test words and his ability to discriminate them. Words that were highly familiar were correctly discriminated more often than those which were less familiar. The listener's familiarity with the test words had no influence on their discrimination scores, when the words were presented at different intensity levels. No significant difference was observed between trained and untrained testers with respect to their familiarity with the test words.

The effect of aging on the speech discrimination ability among a group of subjects of Indian nationality was undertaken by Mani Meghalai (1983).

Total number of subjects tested were seventyfive, which included fifteen subjects from five age groups. 19-29 years, 30-39 years, 40-49 years, 50-59 years, 60 years and above. All were non-native speakers of English.

An important observation was that, the speech discrimination scores decreased with increase in age. The individuals in the second and third decade group performance was found to be almost similar. Similar performance was also noted between the 40-50 years group and the 50-60 years group. Beyond 40 years of age, speech discrimination ability becomes poorer compared to the younger population. This decrement in the ability was maximum for the older group (60 years and above age group) thus reflecting the speech perceptual problem among the aged.

Yet another study in this series was "the effect of training and native language on scoring the response on a speech discrimination test in English" by Elizabeth (1983). She attempted to find out, if native languages of the tester has an effect on scoring the response of a speech discrimination test (NU Auditory Test No.6) in English and if training had a significant effect on the scoring of responses on the speech discrimination test.

The subjects were divided into a group of twenty listeners who were native speakers of Kannada with adequate knowledge of English and forty testers of whom twenty were trained and twenty were untrained. Dravidian and Indo-Aryan group were included in both trained and un-trained groups.

The results indicated that, training does not bring about a difference in the performance of the two groups and the performance of

subjects whose native language is either of the language families is the same.

Though many attempts have been made to standardize English discrimination tests to Indian population, the reports on its clinical applicability are limited. Further studies have shown that performance on speech discrimination tests in native language is better among the native speakers than among non-native speakers (De 1983, Gat & Keith, 1978, Sinha, 1981). And also English speaking people in India are small, hence clinical utility of English discrimination tests is limited. So, many attempts have been made to construct speech discrimination tests in some of the Indian languages. Thus we have:

Discrimination Tests in Hindi: The first attempt to develop Hindi phonetically balanced (PB) words was done by Abrol (1971). His study was based on the frequency analysis of the speech components and familiarity. It has some drawbacks as it did not take into consideration the practice effect and SRT level was not mentioned. The articulation curves were not given.

Later De (1973) developed Hindi lists to be/used all over India. He developed six lists,each list containing fifty monosyllabic words. Subjects for the study were individuals working in Armed forces. Even though the mother tongue was not same for all individuals, their grasp and intelligibility of commonly spoken Hindi was quite adequate for

discrimination tests of hearing. A comparative study was made with English, Hindi, Bengali and nonsense speech material and he concluded that, (1) persons consistently produce better and optimum discrimination scores in their mother tongue as compared to other languages.

(2) Discrimination score obtained with material in second language is fairly reliable.

(3) Subjects having a working knowledge in two languages, none of which are their mother tongue, discriminate better in a language of Indian origin than in a language which is foreign in origin.

A study by Sinha (1981) was carried out to find the effect of linguistic experience on auditory word discrimination of native and non-native speakers of Hindi language. The subjects were grouped according to the duration of exposure to Hindi language i.e., non-native speakers with short and long exposure period were compared with a group of native speakers of Hindi.

All were administered four Hindi PB lists developed by De (1973) at three different signal-to-noise ratios and in quiet. Speech at constant level (76 dB SPL) was presented binaurally. Noise was presented at 12 dB, 6 dB and 0 dB s/N ratio binaurally. He found that there was no effect of linguistic experience beyond exposure of five years on auditory discrimination of Hindi PB words in quiet

conditions, and noise affects native and non-native speakers. But the discrimination scores decreased more for non-native speakers of Hindi than the native speakers and the interaction between noise and linguistic experience, was found to be significant.

Discrimination Test for Children:

The above mentioned tests were for adults, so Anand and Kishore (1974) have attempted to develop speech discrimination test for children. It is a Hindi Picture Identification (Discrimination) test for children in the age group of 5-11 years. The original idea was taken from Seidel's Picture Identification for Children Standardization Index (PICSI).

The test consists of presenting pictures of twentyfive PB Hindi words (majority of them are from PB word lists for adults prepared by De (1973) that have to be identified by the child. The number of correct identifications are converted into percentage to obtain the discrimination score.

But it has a few limitations. The test can be administered only to those children who had normal speech development upto at least 3 to 4 years of age and it can be used with acquired mild to moderate hearing loss children in the age group of 5-11 years (Anand & Kishore, 1974).

Tamil Discrimination Test:- Kapur (1973) made the first attempt in developing materials for speech audiometry in Tamil. It was considered inadequate because of its short comings in phonetic composition and lack of proper standardization (Samuel, 1976). So Samuel (1976) developed speech discrimination test in Tamil language using the familiar meaningful monosyllables of CNC type. It was administered to thirty subjects whose language was Tamil. Articulation gain curve was plotted. Reliability of the test was determined by administering the test to ten of the thirty subjects after a lapse of a week and it was found to be reliable. Further reports on clinical applicability are not available.

Discrimination Test in Kannada:

In Kannada it is difficult to construct PB and spondee word lists as there are only a few monosyllables and a few equally stressed disyllabic words. Hence Nagaraja (1973) constructed synthetic sentences in Kannada to be used in speech audiometry.

Synthetic sentences were constructed using most commonly used words in Kannada language. Ten first order sentences and ten second order sentences were constructed. To make the task more difficult these sentences were recorded with a continuous competing speech message. First three lists of first order and three lists of second order sentences were presented to thirty normal hearing subjects for getting performance

pattern and to find the performance level and NCR level at which performance is maximum. The test was also administered to eight conductive loss cases, four mixed loss cases, ten SN loss cases and two high frequency hearing loss cases to study their performance on this test. He reported that, normal subjects obtain maximum performance scores on SSI test at 40 dB SL end at 0 dB MCR levels. Clinical groups showed significant difference in performance compared to normals. Within the clinical groups performance difference was significant. This test can be used with persons who know Kannada only, and it cannot be used with illiterates. It has not been administered to subjects with different dialects.

Mayadevi (1974) attempted to devise a discrimination test with which people speaking different Indian languages could be tested. She constructed lists of twenty monosyllables of CV combination found in Indian languages. The list was presented to thirty normal subjects at different SLs with PTA as reference. Each test item was preceded by a carrier phrase in Kannada. The levels at which normal subjects obtained maximum scores was taken as the reference level for testing other normal subjects speaking different languages.

Normal subjects obtained 90-100 percent scores on this test at 40 dBSL (ref: PTA). The performances of the subjects speaking different Indian languages also scored 90-100 percent at 40 dB SL (ref: PTA). She has also compared the performance of clinical groups

with the normal group and has found that clinical groups performed differently than normal subjects.

This test has certain drawbacks like, speech stimuli used are not meaningful and therefore they do not possess the property of intelligibility (Lehiste and Peterson, 1959). Kannada carrier phrase has been used to test subjects whose native language was other than Kannada. Thus carrier phrase effect has not been taken into consideration.

The studies reviewed above on speech discrimination tests in Indian languages have been tried in a few languages only and further the reports on their clinical applicability are limited to that language population only. Discrimination tests in Kannada are not available except for SSI (Nagaraja 1973) and none in Telugu language.

The present study tried to evaluate the applicability of the common word lists between Kannada and Telugu for discrimination testing. Since Kannada and Telugu languages belong to the same language family namely, the Indo-Dravidian, the stimuli used were found to be perceived as the words of their native language by Kannada native speakers and Telugu native speakers. (Srilatha, 1983). Hence it becomes possible for the clinician to test two groups of people with the same test material and also when the clinician knows any one of the languages also it becomes easy for him to deal with two groups of people.

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C H A P T E R - III

METHODOLOGY

The present study aimed at determining the performance of native speakers of Telugu on the common word lists between Kannada end Telugu. The methodology was planned to obtain the articulation function for each of these lists.

Test Material:- Bisyllabic words common between Kannada and Telugu constituted the speech stimuli used for testing. (Srilatha, 1983). Four lists of fifty words each were used for this purpose, are given in Appendix I.

Recording Procedure:- The test stimuli were recorded in a sound treated room using a tape recorder (Philips Deck Tape Recorder, F 6112) with an external microphone (Philips LBD 8202). The recording was done in a sound treated audiometric room.

The recording was done by an young adult male talker who was proficient in both Telugu end Kanneda languages. The bisyllabic words were recorded with a carrier phrase "i*ge he:li" and also "ipp du chapp ndi". The level of the carrier phrase was maintained so that the VU meter needle peaked at 0 while the word was allowed to follow in a natural manner. Between successive words a ailent

interval of 10 seconds was given, in order to allow sufficient time for written responses.

The tape was then played on a stereo tape recorder (Philips F 6112). Its output was given to a level recorder (B & K type 2305). The level of all the words of all the lists were recorded on the level recorder. Peak average was found out separately for each list. A 1000 Hz tone was then recorded from a signal generator (LD011 unitec) at the beginning of each list. The level of the 1000 Hz tone was at the level of the peak average.

Instrumentation:- The instruments used for the collection of data were a two channel clinical audiometer (Madsen 0B70) and a stereo tape recorder (Philips F 6112). The output of the tape recorder was fed into the tape input of the audiometer. The output of the audiometer was given to TDH 39 earphones with MX-41/AR ear cushion*. The audiometer was calibrated to ANSI (1969) specifications. Objective calibration was done prior to data collection.

Calibration Procedure

1. Pure tone calibration;- Calibration was checked for both intensity and the frequency of the pure tones generated by the audiometer (Madsen 08 70 Clinical Audiometer).

1.a Intensity Calibration:- All intensity measurements were done when the audiometer output was set at 70 dBHL. The acoustic

output of the audiometer was given through earphones (TDH 39 with MX-41/AR ear cushions) to condenser microphone (B & K 4144) which was connected to an artificial ear (B & K 4152). The microphone was connected into a pre-amplifier (B & K 2616). The signal was then fed into a Audio-frequency analyzer (B & K 2107). The SPL values at the corresponding frequencies were noted. Whenever the difference between the observed SPL value and the expected value (ANSI, 1969) was more than 2.5 dB, internal calibration was done by adjusting the presets in the audiometer. Thus the output levels of the eudiometer was well within 2.5 dB with reference to the standards.

1.b Frequency Calibration:- The frequency of the pure tones were checked using a Rodart 203 timer/counter. For this the electrical output of the audiometer was given. The frequency generated was very close to the frequency reading on the dial and the difference between the two never exceeded 30% of the dial reading.

1.c Earphone Frequency Response Characteristics:-
A beat frequency oscillator (B and K 1022) and a level recorder (B and K 2305) were utilized to establish the frequency response characteristics of the earphones. Frequency calibration of BFO was done previously. The electrical output of the BFO were fed to the earphones (TDH 39 with MX-41/AR ear cushions) that were used

during the study. The earphone output was picked up by a microphone (B and K 4144) which was connected to a pre-amplifier (B and K 2616). Further, this output was fed to a level recorder (B and K 2305). Thus a graphic recording of the frequency response of the earphones was established on recording paper, copy of which is given in Appendix II.

Test Environment:-

All the measurements were done in a sound treated, control and test room combination. The noise levels in the test room were measured with a sound level meter (B and K type 2209) with its associated filter set (B and K 1613) with a condensor microphone (B and K type 4145). The noise levels in the test room were within the permissible limits (Appendix III).

Subjects:-

Forty subjects (twentyone females and nineteen males) in the age range of 17 years to 25 years.served as subjects. The mean age was 20.2 years. The criteria for selection of subject were as follows:

(1) The subject should be a native speaker of Telugu.
(2) He/She should know both reading and writing Telugu.
(3) He/She should have an air conduction threshold of level than or equal to 20 dB at frequencies 250 to 8000 Hz (ANSI 1969) in both ears.
(4) He/She should have a negative history of ear diseases and head injury.

Test Procedure:-

First the air conduction thresholds of both ears were obtained using the modified Hughson-Westlake procedure.

Speech Discrimination Test Procedure:- Speech discrimination was tested using the four bisyllabic word lists common between Kannada and Telugu. Five presentation levels viz., 8, 16, 24, 32 and 40 dB above PTA were employed. All the four lists were heard by all the subjects, but at different sensation levels, the list and sensation level combinations were arrived at using a random number table. The criteria used for assigning the levels to different subjects were:
(i) no list would be presented more than once to any subject and (ii) no level will be repeated for any subject. Thus twenty subjects heard different lists and level combinations.

Out of forty subjects, twenty subjects were presented the lists with the Telugu carrier phrase (Experimental condition I) end other twenty subjects listened to the lists with Kannada carrier phrase (Experimental condition II). Equal representation was given for the two ears. Thus, right ear was the test ear for ten subjects in experimental condition I (five males and five females). Left ear was the test ear for the remaining ten subjects (seven females and three males).

Similarly in the second experimental condition, out of twenty subjects, right ear was the test ear for ten subjects (six females and four males). Left ear was the test ear for the other ten subjects (three females and seven males).

The test ear for a given subject was chosen depending on the pure tone average of 500 Hz, 1000 Hz and 2000 Hz. When the PTA was equivalent in both ears, test ear selection was done at random. Only one ear was tested for a given subject.

The subject was provided with four response sheets on which he/she had to write down the response. The subject was then instructed as follows:

Instruction:- "You will now hear four lists of fifty words each. Some lists will be louder and some softer. Before each word, you will hear the phrase, "ippudu chappandi..." (for first experimental condition) and "i:ga he li....." (for second experimental condition). Concentred on the word that follows the phrase and write it down against the serial numbers printed on the sheet. If you are doubtful of the word, try to guess it and write. If you feel you are unable to guess, leave a blank against the number and go on to the next. Is everything clear to you?"

The lists were presented at the previously assigned levels. The order of presentation of the lists was also randomized. All the four lists were presented in a single session.

Scoring:-

The data sheets were scored manually on a "right" or "wrong" basis. Each correct response was given a credit of 2%. Total percentage of correct responses at each level was computed for each list.

The scores obtained were analyzed using statistical procedures.

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C H A P T E R - IV

RESULTS

The data collected were analyzed so as to obtain the mean and median scores for each list at each level. The dispersion of the scores was also determined by computing standard deviation. These three measures i.e., mean, median and standard deviation were computed for all the four lists separately and for both lists with Telugu carrier phrase as well as for lists with Kannada carrier phrase. Their values are as given in Table I and Table II.

Effect of Sensation Level:

From Table I and Table II it may be noted that the discrimination scores increased with an increase in sensation level. There was no consistent decrease in variability with increase in sensation level for different lists except for list II. This consistent decrease in variability was observed for List II in both the experimental conditions i.e., with Telugu carrier phrase and Kannada carrier phrase.

Figure 1 and Figure 2 show the articulation functions for the four lists with Telugu carrier phrase and Kannada carrier phrase respectively. From the figures it may be noted that the discrimination scores increased with increase in sensation level.

However, maximum score of hundred percent was not obtained for any of the lists.

The slopes of the articulation function are 3.38%/dB (list I), 4.75%/dB (list II), -0.44%/dB (list III) and 2.06%/dB (list IV) with the Telugu carrier phrase. For lists with Kannada carrier phrase the slopes were 3.7%/dB (list I), 2% /dB (list II), 3% /dB (list III) and 2.3% /dB (list IV).

In addition to the measures of central tendency and of variability, two-way Analysis of variance (ANOVA) (Guilford & Fruchter 1978) was also computed. Results of the two way ANOVA are given in Table I, Table II and Table III. F ratios for sensation levels and carrier phrase were significant at $P \leq 0.01$ level (Table I, Table II & Table III).

Inter list Difference:

From Table I and Table II it can be seen that with no list the mean discrimination scores obtained were consistently higher or lower. Standard deviation was high at lower sensation levels for all the lists.

Figure 1 and Figure 2 show that the four lists over lap in both the experimental conditions.

F ratios shown in Table I and Table II for list difference and interaction between list and sensation level was not significant even at $P \leq 0.05$ level.

Effect of carrier phrase:- As seen in Table I and Table II, the mean scores obtained were higher when Telugu carrier phrase was used than with Kannada carrier phrase.

Since the list difference was not found significant the four lists with Telugu carrier phrase were combined together and four lists with Kannada carrier phrase were combined together. The Figure 3 shows that scores obtained with Telugu carrier phrase is higher than scores obtained with Kannada carrier phrase.

F ratio for the main effect of carrier phrase was found to be significant at $P \leq 0.01$ level (Table III).

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Table I: Results of Two-way ANOVA for the main effects of lists, levels and their interaction when the words were preceded by Telugu carrier phrase.

Source of Variance	Sum of Squares	Degree of Freedom	Mean Squares	F Ratio
Levels	9920.2	4	2480.05	22.481*
Lists	230.95	3	76.98	0.6978
Interaction	2681.80	12	223.48	2.02574
Error	6619	60	110.32	
Total	19451.98	79	246.23	

* Significant at $P \leq 0.01$ level.

Table II: Results of Two-way ANOVA for the main effects of lists, levels and their interaction when the words were preceded by Kannada carrier phrase.

Source of Variance	Sum of Squares	Degree of Freedom	Mean Squares	F. Ratio
Levels	16919.80	4	4229.95	29.69*
Lists	437.75	3	145.92	1.024
Interaction	1101.00	12	91.75	0.644
Error	8547.00	60	142.45	
Total	27005.55	79		

* Significant at $P \leq 0.01$ level.

Table III; Results of Two-way ANOVA for the main effects of levels, carrier phrase, and their interaction.

Source of Variance	Sum of Squares	Degree of Freedom	Mean Squares	F. Ratio
Levels	26312.3	4	6578.08	50.299*
Carrier phrase	1313.2	1	1313.2	10.041*
Interaction	446.6	4	111.65	0.854
Error	19617.5	150,	130.78	
Total	47689.6	159		

* Significant at $P \leq 0.01$

Table 1: Mean, Median and Standard Deviation (50) of discrimination scores obtained for four lists at different sensation levels when the words were preceded by Telugu Carrier Phrase.

	List I			List II			List III			List IV		
	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.
8 dB	57.5	58	13.89	53	43	27.93	79	83	10.13	73.5	78	11.93
16 dB	84.5	87	13.40	91	89	5.29	75.5	94	33.16	90	92	5.16
24 dB	91.5	88	4.44	98	99	1.63	93	92	5.29	86.5	82	11.12
32 dB	92.5	89	7.00	98	99	1.63	93	97	5.71	91.5	89	3.42
40 dB		92	3.83	97.5	98	1.00	97.5	96	1.92	96	93	3.65

Table 2: Mean, Median and Standard Deviation (50) of discrimination scores obtained for four lists at different sensation levels when the words were preceded by Kannada Carrier Phrase.

	LIST I			List II			List III			List IV		
	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.
8 dB	55.5	42	30.52	55	68	23.12	58.5	56	18.57	50	55	18.40
16 dB	85	86	2	71	73	18.66	82.5	86	5.26	68.5	59	24.67
24 dB	90.5	89	6.81	79.5	81	10.88	87.5	85	8.06	94	96	4.32
32 dB	90	91	1.63	91	94	3.83	91.5	92	4.12	95.5	93	3.79
40 dB	97	98	2	92	90	2.31	95	96	3.83	94	98	6.93

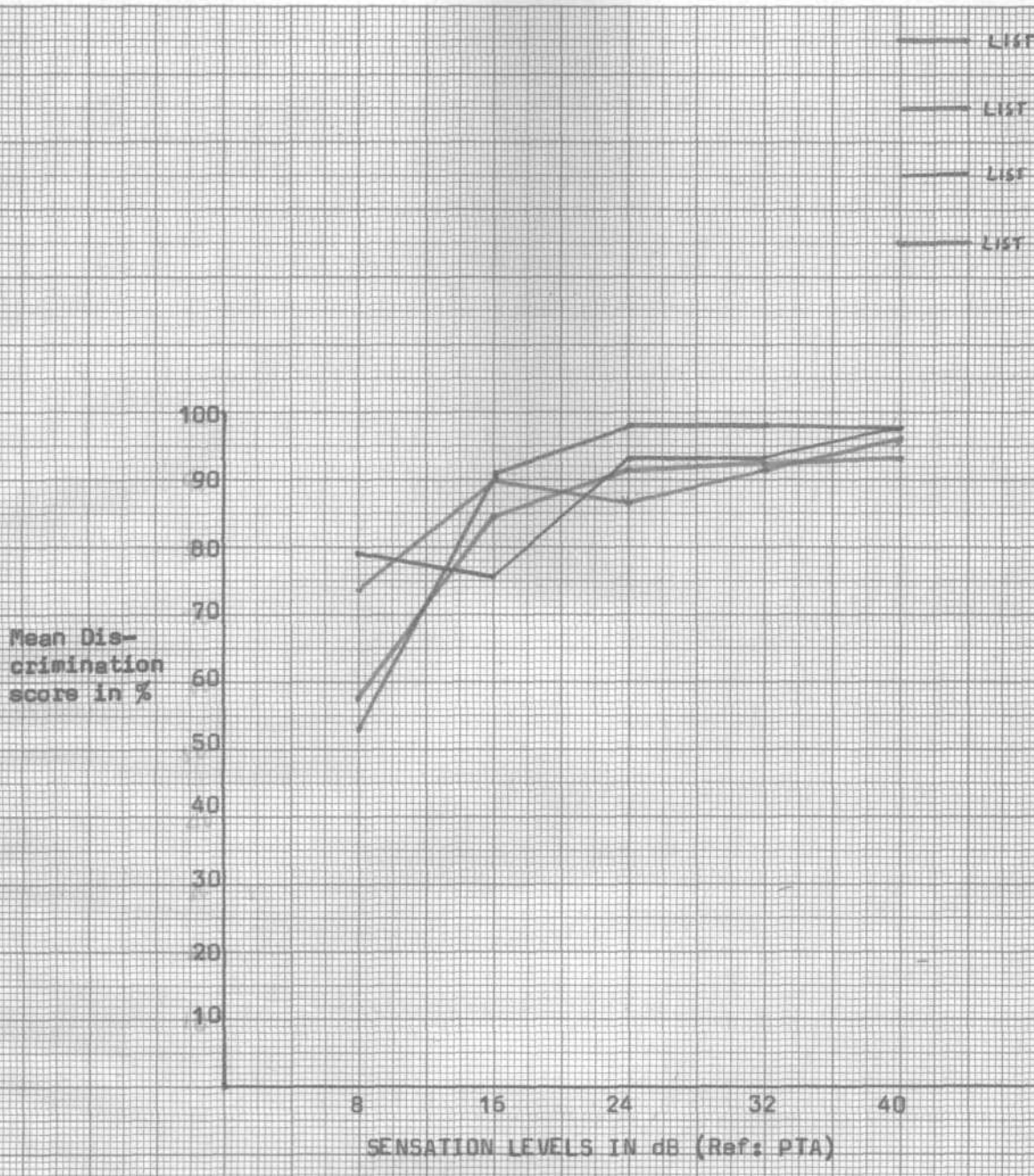

FIGURE 1: Articulation functions for four different lists when the words were preceded by Telugu Carrier Phrase.

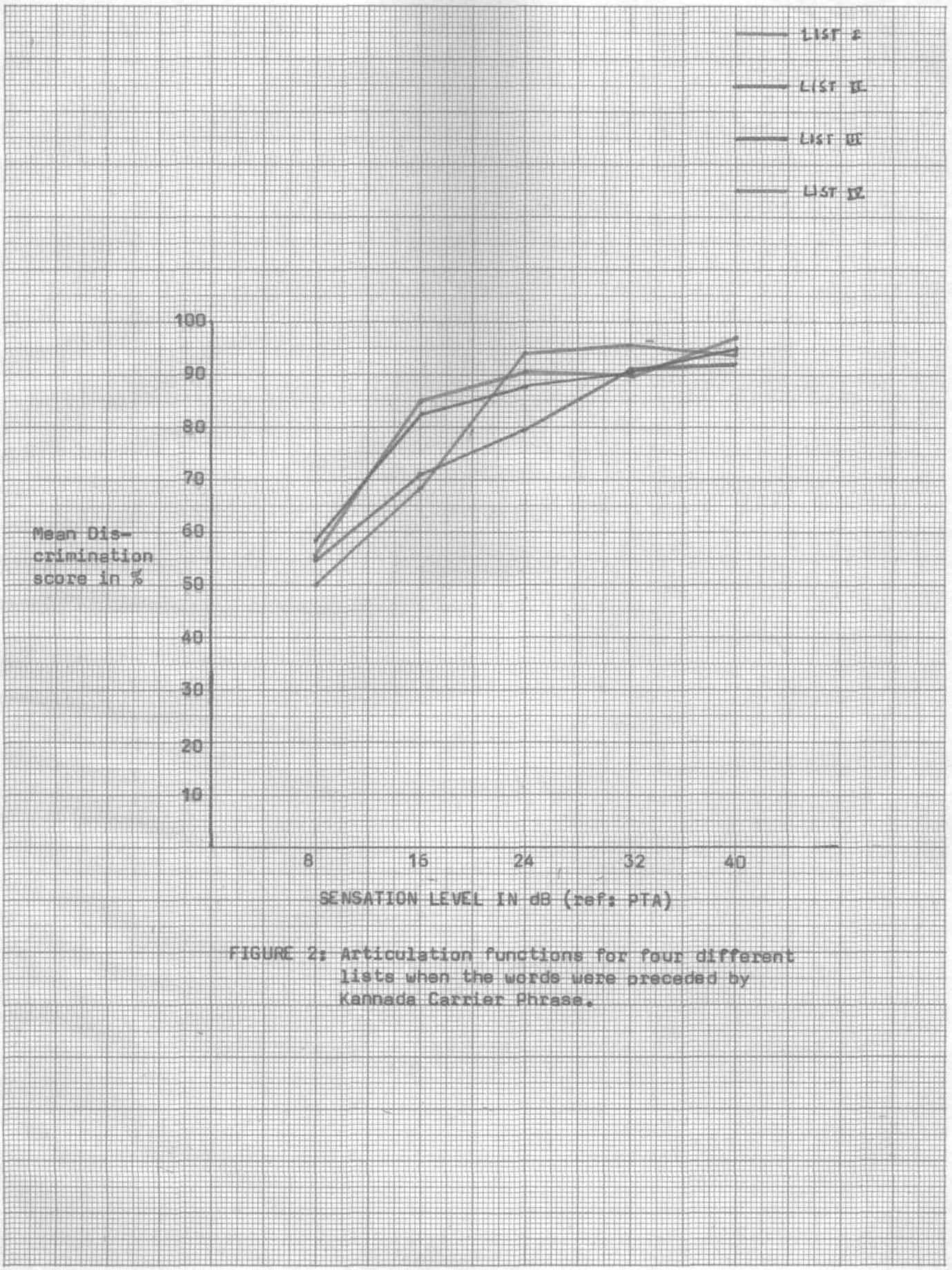

FIGURE 2: Articulation functions for four different lists when the words were preceded by Kannada Carrier Phrase.

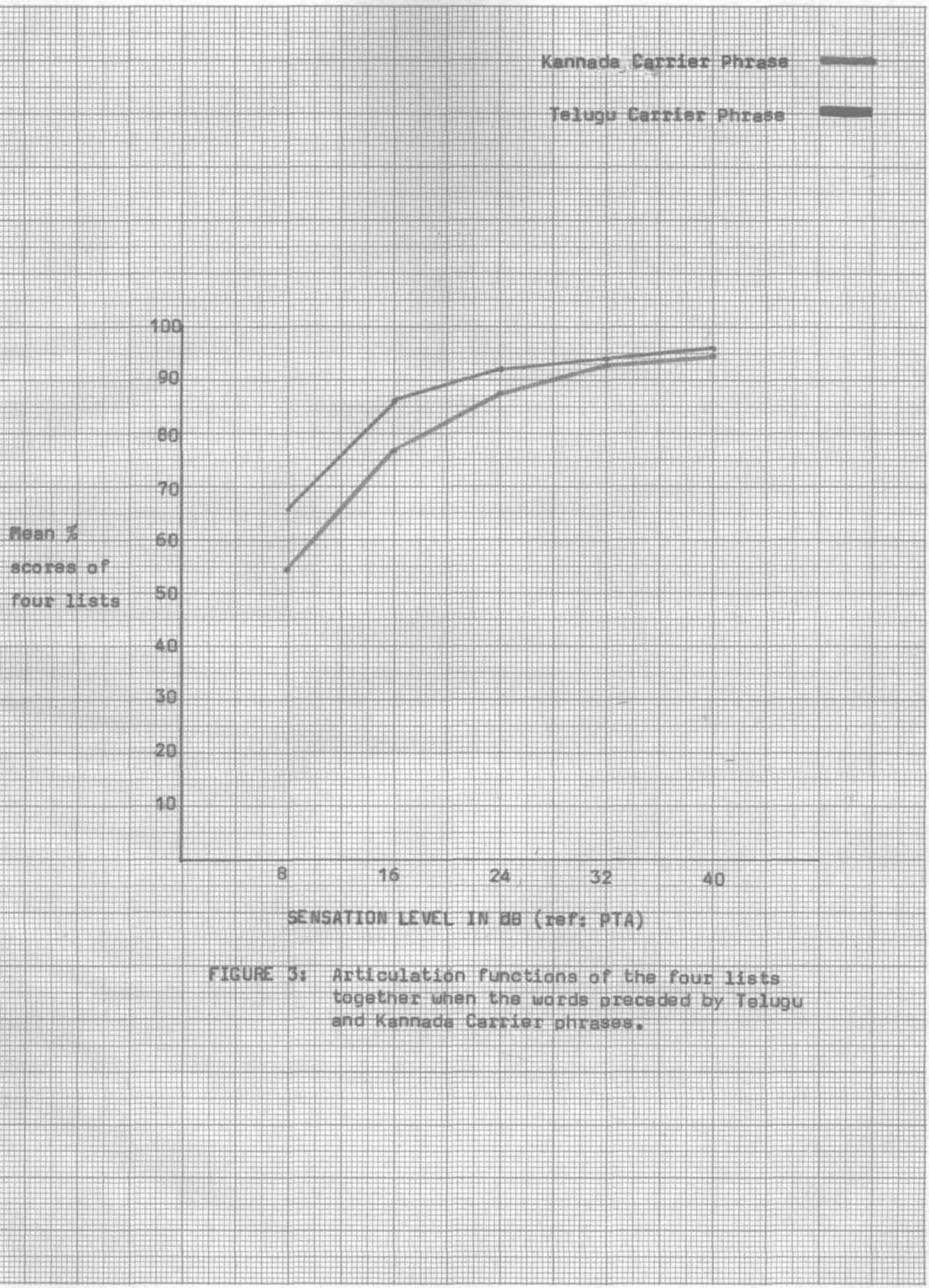

FIGURE 3: Articulation functions of the four lists together when the words preceded by Telugu and Kannada Carrier phrases.

C H A P T E R - V

DISCUSSION

The results obtained in the present study is discussed in terms of the effect of sensation levels on discrimination score, inter list difference and effect of carrier phrase on the discrimination score.

Effect of sensation level:-

The articulation function for the four lists with Telugu carrier phrase and Kannada carrier phrase show that, the discrimination score increased with increase in sensation level. However, the maximum score of hundred has not been reached at 40 dBSL. This may be because the reference level taken was PTA and not SRT. It needs to be checked at higher levels to see if there will be further increase in discrimination score and that 100 percent score will be obtained*

Interlist difference:-

As seen in Table I and Table II interlist difference is not significant at p 0.05 level. Thus the lists are equivalent in difficulty when the carrier phrase used is common among them. Hence the four lists with Telugu carrier phrase can be used interchangeably.

Similarly the four lists with Kannada carrier phrase can be used interchangeably.

Effect of carrier phrase:-

A carrier phrase in speech audiometry is used to alert the listener for the test word and allow the announcer to monitor his voice, but the exact content of the carrier phrase is not considered important (Egan, 1944; Carhart, 1952). Later studies indicated that the operation of a preceding phoneme on a succeeding one, did influence the intelligibility of speech (Gladstone and Siegenthaler, (1971) with a change in the carrier phrase, a viation in the discrimination scores has been noted by Kruel et al (1969) employing the modified Rhyme test.

Gladstone & Siegenthaler (1971) using the CID W-22 teat found a difference of score of 7% as a function of carrier phrases. They said that the intelligibility of the carrier phrase "You will say....." enhanced the scores, because of the long vowel /ei/ at the end of the carrier phrase.

In agreement with these studies, the present study shows that there is a significant effect of carrier phrase on discrimination score. Figure 3 shows that the higher scores obtained with the Telugu carrier phrase is statistically significant than scores obtained with Kannada carrier phrase at all sensation levels.

The higher scores obtained for the lists with Telugu carrier phrase could be attributed to the (1) effect of native language on the perception of words. Though the lists were identical, the carrier phrase in the native language aided in better performance and hence higher scores obtained with the Telugu carrier phrase, several studies have shown that the performance of word discrimination is better in the native language than in the non-native language (De 1973, Sinha, 1981, Malini, 1981).

(2) Higher scores obtained with the Telugu carrier phrase could be due to the stress and more number of syllables in the Telugu carrier phrase. A study of Usha (1984) showed that non-native speakers of Telugu also obtained higher scores for the lists with Telugu carrier phrase which supports the hypothesis that stress and more number of syllables of the Telugu carrier phrase could have contributed to the higher scores obtained.

The four lists consisted of words common to both Telugu and Kannada languages. They were perceived as words from their native language by both native speakers of Telugu and native speakers of Kannada without the carrierphrase at a comfortable listening level (Srilatha, 1983).

Clinical Implications:- The present study showed that these lists can be used to test the speech discrimination of native speaker of Telugu. However, as the carrier phrase was found to have a significant effect on discrimination score, separate norms for lists with Telugu carrier phrase and Kannada carrier phrase have to be used.

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C H A P T E R - VI

SUMMARY AND CONCLUSION

The present study aimed at establishing articulation function for the common word lists between Kannada and Telugu for native speakers of Telugu. The four lists with Telugu carrier phrase and Kannada carrier phrase were recorded on cassette tape* They were presented through the tape input of a clinical audiometer (Madsen 08 70) at five sensation levels i.e., 8, 16, 24, 32 & 40 dBSL (ref: PTA).

Forty young adults (age range 17 years to 25 years) served as subjects. They were selected only if they had the reading and writing knowledge of Telugu and hearing sensitivity was within 20 dBHL (ANSI 1969) for pure tones from 250 to 8000 Hz at octave intervals.

Twenty subjects were presented four lists of words preceded by a Telugu carrier phrase and the remaining twenty were presented the lists with Kannada carrier phrase. The sensation levels and the lists were presented in a predetermined random order.

The scores obtained were analyzed to determine the central tendency (mean and median) of and the variability (standard deviation)

in the scores. In addition two-way Analysis of variance (Guilford & Fruchter 1978) was also computed.

Based on the results obtained in the study, the following conclusions can be drawn:

1. Discrimination scores increase with an increase in sensation level.
2. The four lists are equivalent in difficulty. Thus they can be used interchangeably.
3. There is significant effect of carrier phrase on discrimination scores obtained.

The common word lists between Kannada and Telugu can be used to test the speech discrimination of native speakers of Telugu. Telugu carrier phrase or Kannada carrier phrase can be used, but not interchangeably. Appropriate norms should be used for the lists with Telugu carrier phrase and Kannada carrier phrase.

Suggestions for further Research:

1. To present these lists at 48 dBSL (ref: PTA) to see if the scores improve further and on asymptotic level is reached at this level.
2. To study the test-retest reliability.
3. To investigate the diagnostic utility of the test on a clinical population.
4. To study the intelligibility of these words under different acoustic conditions such as different S/N ratio, filtering and time-compression.

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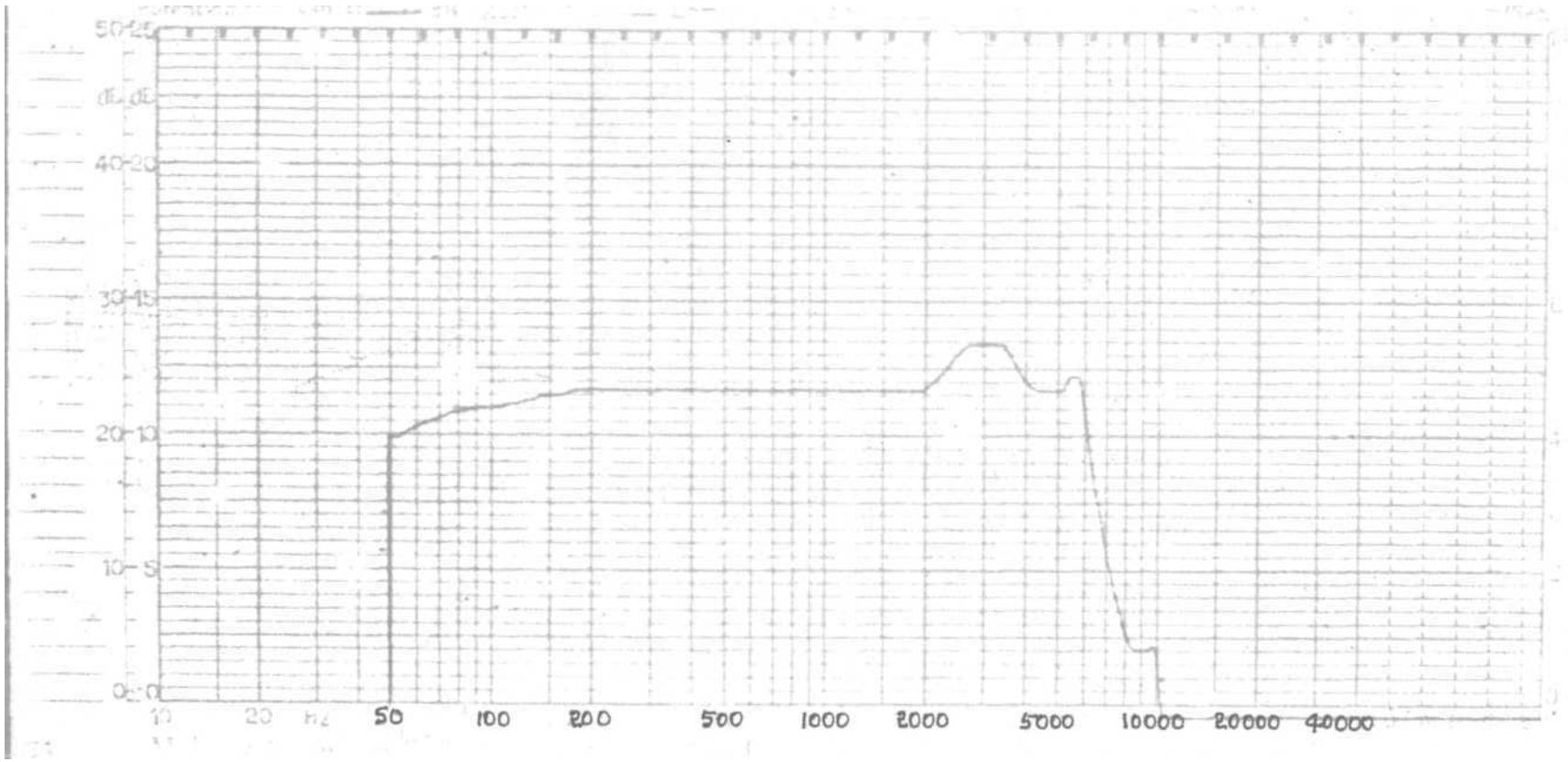
APPENDECES

APPENDIX - I

	LIST I		LIST II		LIST III		LIST IV	
1	miṭi	kuːḍu	gaṭṭi	oṭṭu	ʤoːḍu	kɔṭṭu	aːṭma	eḍḍu
2	impu	kaːlu	eṭṭu	arḍʰa	gundi	budḍʰi	kaḷḷu	gunḍu
3	puʃṭi	kaḍa	naːri	baniḍa	kʰuːni	ḍruʃti	uːta	ʤaːṇi
4	bali	tripṭi	biːḍu	aːme	ʃruṭi	ʤeːbu	kappu	goːri
5	ṭaːʤa	arʤi	oːḍu	saṇḍi	aːḍi	anna	goːvu	giri
6	kaṭṭi	bʰraːnṭi	koṭṭu	spuːṛṭi	sari	gaːli	kaṭṭu	guːḍu
7	mukku	pakka	siːsa	ṭeːru	gnani	amma	ṭaːṭa	pada
8	mari	dammu	boṭṭu	kunḍa	kʰarʧu	masi	kaːvu	ṭaḷḷu
9	peːṭa	vaːḍi	paṛi	paːvu	muːrṭi	akka	ʤaːga	kaːṭa
10	ʧaːku	maːṭa	baːvi	ʧuːpu	muri	kanja	nidʰi	kaːḷi
11	niːru	maṇḍa	kapi	stʰiṭi	bʰarṭi	beːḍi	angi	aːru
12	naṭi	kaːḍu	bassu	nalli	ṭaggu	mujji	ʤama	maga
13	ṭula	aṇṭu	paḍi	kiːrṭi	ḍaːsi	ʧiːṭi	ʤari	puːri
14	asṇʰi	vidja	mara	baːṭu	hamsa	ṭoːpi	paisa	muṭṭu
15	miːru	naːnḍi	ṭaːḷi	ravi	ʧellu	ṭjaːgi	aiḍu	ṭuːka
16	krimi	dwaṇḍwa	maṇḍi	lakʃa	ruʃi	kaːnṭi	puːṛṭi	swaːmi
17	prati	paṭṭu	vjakṭi	baḍi	kavi	gaṭi	lekkʰa	dʰwani
18	aːsṭi	ṭappu	oppu	ṭanṭi	ṭiːrpu	baṭṭi	roːgi	niːli
19	ḍanḍa	koːṭu	naːru	mnaːṭra	ḍeːvi	ḍeːra	ʧinna	rubbu
20	paːpa	muːla	nagu	koːḍi	manṭri	pairu	koːṭi	ṭaːvu
21	ʤʰari	iḍe	uːru	ṭakka	naḍi	niːvu	praːṇi	paṭni
22	peṭṭu	aʧʧu	raːgi	oːṭu	aṭi	ḍroːhi	kaːru	daja
23	piṇḍi	vrudḍʰi	pakʃi	railu	guḍḍa	naːḍu	maːḍu	roːṭu
24	anʧu	aṭṭa	nuːru	nuːku	ḍarʤi	bʰaːvi	ḍaːri	niːṭi
25	ḍaːni	bandi	ṭoːdu	ḍabbi	ṭaːnga	peḍḍa	aḍeː	uppu



Frequency Response Characteristics of Earphone 1 RIGHT

Frequency Response Characteristics of Earphone 2 LEFT

APPENDIX III

The noise levels in the test room were as follows;

Octave frequencies in Hz	level in dB A
125	29
250	20
500	11
1000	13.5
2000	12.5
4000	14.5
8000	8