DEVELOPMENT AND STANDARDIZATION OF SPEECH TEST MATERIALS IN MANIPURI LANGUAGE

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MY PARENTS

CERTIFICATE

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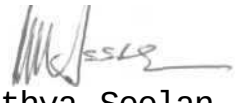

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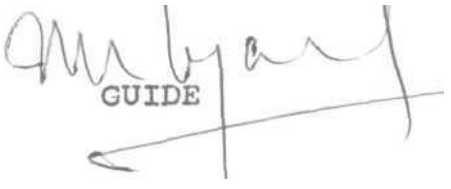

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TABLE OF CONTENTS

CHAPTER			PAGE NO.
1.	INTRODUCTION	--	1-3
2.	REVIEW OF LITERATURE	--	4-28
3.	METHODOLOGY	--	29-33
4.	RESULTS AND DISCUSSIONS	--	34-48
5.	SUMMARY AND CONCLUSION	--	49-50
	BIBLIOGRAPHY	--	51-53
	APPENDICES	--	54-60

INTRODUCTION

LIST OF TABLES

No.		Page No.
1.	Mean discrimination scores(%) at different sensation levels for lists A to D	36
2.	Mean of the percentage of correct polysyllabic words at six hearing levels.	37
3.	Difference between SRT and PTA for Different lists.	38

LIST OF FIGURES

No.		Page No.
1.	Mean articulation curve for polysyllabic works (List-A)	39
2.	Mean articulation curve for Polysyllabic words (List-B)	40
3.	Mean articulation curve for polysyllabic words (List-C)	41
4.	Mean articulation curve for polysyllabic words (List-D)	42
5.	Articulation curves of polysyllabic words (List A-D) and English list.	43
6.	Mean articulation curve for monosyllabic words (List-A)	44
7.	Mean articulation curve for monosyllabic words (List-B)	45
8.	Mean articulation curve for monosyllabic words (List-C)	46
9.	Showing mean articulation curve for monosyllabic words (List-D)	47
10.	Articulation curve of monosyllabic words (List A-D) and English list.	48

INTRODUCTION

Speech Audiometry plays an important role in clinical audiological evaluation as it has become an integral part of the otological and audiological diagnosis of hearing impairment.

Puretone audiometry is basic to clinical audiology but it alone does not provide any information about a person's ability to hear above the threshold. The pure tone information alone is inadequate in diagnosis and differential diagnosis of certain auditory disorder because they do not require psychic integration or synthesization in order to be perceived (willeford 1969). However speech audiometry result alone has limited diagnostic value. But it provides useful information when combined with other test results So speech audiometry usually supplement An pure tone test results.

In speech audiometry, various measures may be obtained viz. speech reception threshold, threshold of detectibility, threshold of tolerance or discomfort level, social adequacy index, speech discrimination score etc.

A variety of materials such as words (monosyllabic, disyllabic and polysyllabic), nonsense syllable, sentence, continuous discourse etc. have been used as material for speech audiometry.

Speech stimuli are usually employed to validate pure tone test results. A comparison of pure tone threshold and threshold of intelligibility aids in the detection6f functional hearing loss. (Feldman

1967? Martin 1972; Williamson 1974) speech stimuli aid in detecting disturbances which may go unnoticed if pure tone alone are used. Pathologies in the retrocochlear region and higher auditory pathways may not manifest itself in puretone hearing loss despite significant difficulty in speech discrimination (Goetzinger, 1972? Hodgson, 1972). Speech is the preferred test material for assessing higher cortical functions. It is also helpful in assessing success in otological surgery (Kasden and Robinson, 1969, 1970). They are used for hearing aid evaluation. Speech materials also contribute to the assessment of communicative ability (David, 1960? Berger, Keating and Rose, 1971).

It assess the value of therapeutic procedures such as speech reading and auditory training (Hirsh, 1947).

Thus, the use of speech material is a must for accurate diagnosis and for appropriate choice of treatment procedures.

Need of the study:

Speech audiometry has gained widespread acceptance in audiological evaluation. So in recent years different types of speech materials has been developed.

Developing a common speech material is not possible in India as we have many languages. Speech test materials are available in many Indian languages such as Hindi (Abrol, 1970? De 1973), Kannada

(Nagaraja, 1973? Rajashekhar, 1976? Hemalatha 198l), Malayalam (Kapur, 1971), Tamil (Kapur 1971, Samuel, 1976), Gujarathi (Mallikarjuna 1984).

The individual's perception of speech is influenced by his mother tongue (weinrich 1954? Delattre, 1964? Singh, 1966? Singh and Black, 1966? Gato, 1971). So administering test in subject's native language is considered to be ideal. Since speech audio-metry is extremely useful in the assessment of hearing loss cases, there is an urgent need for the developing and standardizing speech materials in Manipuri language for assessing hearing of the subjects who know Manipuri language only.

Therefore the present study attempts at constructing and stanaardizing speech test materials in Manipuri language.

Purpose of the study:

1. to develop speech test materials in Manipuri language to obtain SRT and discrimination.
2. to standardize the test materials by finding the articulation curves in Manipuri speaking normal hearing subjects.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Interest in the use of speech stimuli in hearing evaluation is not a recent origin. Over a century ago, Wolf (1874 cited in O'Neill and Oyer, 1966) pointed out that, speech stimuli could be used to evaluate the status of the auditory system. Although Wolf stressed the utility of speech stimuli in audiological evaluation as early as 1874, it failed to gain usage for clinical purposes.

The use of speech materials in routine audiological evaluation began as a result of the work done at the Psycho Acoustic Laboratories of the Harvard University (Egan 1948).

The earliest application of speech audiometry stressed the measurement of threshold sensitivity utilizing speech testing materials developed to assess the efficiency of communication systems. Establishment of the aural rehabilitation programs by the united states military during the Word War-II resulted in the expansion of speech audiometry to include suprathreshold testing of speech discrimination for both diagnostic and rehabilitative purposes.

Among all the measures, speech reception threshold and speech discrimination are basically used in routine audiological evaluation,

Speech reception threshold is the intensity level in which the subject is able to repeat 50% of the stimuli presented to him and speech discrimination is the ability to repeat words correctly at a suprathreshold level.

The speech reception threshold serves many clinical purposes. The basic purpose is to quantify the listener's hearing level for speech. It is a basic measure upon which the suprathreshold speech tests are based. It serves as a validity check for the pure tone audiogram. It is used in audiological rehabilitation particularly in hearing aid evaluation.

Speech discrimination testing make it possible to evaluate the functional integrity of the auditory system. The poorer the speech discrimination score, greater is the involvement of the sense rineural mechanism. Speech discrimination scores can be used to differentiate cochlear from retrocochlear pathology in addition with other test results.

Moderate deterioration in speech discrimination is a frequent symptom in Meniere's disease i.e. impaired discrimination beyond the degree of pure tone loss is characteristics of Meniere's disease (Shanbaugh 1967).

Presbycusis may be classified in terms of whetner patients have suffered a breakdown in clearity of speech perception which is out of proportion to the pattern of their pure tone loss: Schuknecht (1955, 1964) has expressed the view that such a breakdown charac-terizes presbycusis due to neural rather than epithelial atrophy.

Early otosclerosis discriminate like normal persons. Advanced otosclerotic show a tendency to produce discrimination loss depending on the degree of deafness.

This discrimination test has got diagnostic utility.

The above two measures of speech audiometry have prognostic value for otological surgery and utility of sensory aids.

Various kinds of speech stimuli have been used to determine the SRT. They are sentences, connected discourse, spondaic words, spoken digits etc.

The kind of stimuli used for speech discrimination testing are monosyllables; nonsense syllables, synthetic sentences etc*

Sentences:

The relationship between word lists used in the measurement of intelligibility and the continuous flow of words encountered in conversation is not clear. So sentences are considered to be more valid indicators of intelligibility.

Relatively few speech discrimination tests have been developed using sentence materials.

Fletcher and Steinberg (1929) used sentences in their early work at Bell Telephone Laboratory. These lists consisted of interrogative sentences that were to be answered instead of repating the stimulus that was present. These lists were not so useful as it not only demands the observer hear the words of the sentence but also to provide answers to some fairly difficult questions. And the subject was expected to have some knowledge of New York city and its environment.

A more simple lists of sentences were constructed at the psychoacoustic laboratory by Hudgins et al (1942) in the name of Auditory Test No.12. The questions were relatively simple and could be answered by a single word. This feature was useful when a written (1. cited in Hirsh (1952); 2. Cited in ONeill and Oyer, (1966), test for use in group testing is desired. When a single subject was tested he was allowed to repeat a sentence he heard.

Hughson and Thompson (1942) found a good degree of correlation between the SRT for sentences and the pure tone average.

Berger (1969) embedded phonetically similar Key words within sentences in the Kent State University Speech Discrimination Test. Any one of five Key words in each sentence can be used meaningfully and correctly in the sentence. Subjects are instructed to identify the correct Key word presented in a sentence context. The test material is presented using audiotape or monitored live voice. Scoring is based on a percent correct basis.

To control for word familiarity, word and sentence length syntactical structure in sentence discrimination Jerger, Speaks and Trammell (1968) developed syntactic sentence material. Although they are not meaningful sentences, the word sequence within a sentence follows normal rules of English syntax. Sentences are presented in a closed-set response format usually with a competing message of continuous discourse at OdB signal to noise ratio.

Kalikow et al (1977) developed the Speech Perception in Noise (SPIN) test materials to measure sentence discrimination. Sentences were recorded in 12 speaker background. Primary and competing message are recorded on separate channels to permit variation in P/CN ratio. Half of the 500 sentences (50/form) were constructed to end in monosyllabic nouns of low predictability. Scoring was based on the subject's ability to correctly identify the final word in an open set response format. Preliminary research finding suggest that the SPIN test results may provide a more realistic estimate of speech discrimination ability under everyday listening conditions than other more traditionally employed measures (Hutcherson et al 1979).

The disadvantage of sentence tests are that long lists are necessary because the same sentence cannot be used twice with one listener and his memory makes it much easier for him to recognize a sentence again even from a single word Key. But the test have high tree validity as samples of English speech.

Connected discourse:

Continuous discourse was considered to be a valid representation of speech. Although difficult to quantify with/respect to the response of the observer, the most valid sample of English speech is a paragraph or several paragraphs of continuous discourse (Hirsh, 1952). The available material is so uniformly monotonous and unin-

teresting that a speaker can/repeat the material with remarkably little variability in intensity. The listener (experimenter) has his own criteria of what is just intelligible.

Fletcher and Steinberg (1929) used lists of questions to which the listener has to give answers.

Hudgins et al (1947) developed easier tests by requiring the listener simply to repeat the questions.

Fry and Kerridge developed five sentence tests comprising statements rather than questions.

Falconer and Davis (1947) employed a sample of connected discourse to which the subject listened and adjusted the level of the recorded speech to a point where he could just understand what was being said. The test was compared experimentally with auditory test No.1 and the thresholds obtained were found to be identical. The test was reported to have the advantages of speed, interest for the listener and less mental fatigue, high face validity, good reliability and negligible learning effects.

The disadvantage of the test was they are subjective in nature and some subjects could give an erratic threshold (Falconer, 1948).

Disyllabic Words:

With the advent of world war-II considerable research effort was directed toward the development of speech tests that could be

employed in the evaluation of military communication equipment and systems. A major share of this word was carried out at Harvard University in the Psychoacoustic Laboratory. This led to the construction of speech reception tests based on the concept of threshold of hearing speech. The first test No.9 and the auditory test No.14. The difference between the two was that test No.9 recorded at attenuated levels and test No.14 at a constant level. They used the same list. Hudgins et a1 (1947) selected the spondaic words under the following criteria:

1. familiar to listeners
2. dissimilar in phonetic construction
3. a normal sampling of English speech sounds and
4. homogeneously audible.

Some of the major deficiency of above lists.were that dertain of the records of auditory test No.9 yield slightly different thresholds from other of these records (Hirsh et a1 1952 P.321). And also that the vocabulary was too large for many clinical patients.

To overcome these limitations, Hirsh et al (1952) modified the Harvard lists at the Central Institute of Deaf. They were named in test CID W-1 and W-2 which is CID recorded versions of auditory test No.14 and No.9 respectively. Their aim was to restrict the vocabulary level to suit the clinical population. They determined familiarity of ariginal 84 words and selected 36

familiar words which then recorded into six different forms. Words that were too easy were reduced by 2 dB and the most difficult words were increased by 2dB.

Difference between the test results obtained with the Harvard tests and the CID test were that lower thresholds were obtained with the latter test. Threshold for the original spondee were on the order of 22 dB while an average SRT of 14-15 dB was obtained for W-l lists. Also, different thresholds were obtained when the attenuated recording (W.2) was used. The difference was on the order of 4 dB (18 dB as compared to 14 or 15 dB for the w-l test).

Although speech thresholds are obtainable using various materials such as monosyllable, sentences and discourse, they were less frequently used than spondees (Harris, 1965). Spondaic words are specified as the standard material for the determination of SRT (ASHA, 1979).

Nonsense Syllable:

Using nonsense syllable focus on intelligibility or repeat-ability of specific phonetic elements. The advantage of using nonsense syllable is that their intelligibility is not dependent upon the vocabulary of the listener (Berger 1978) and it satisfies a criteria of test of speech discrimination that is non redundant (Carhart 1965). Also it is easier to construct lists of comparable difficulty using nonsense syllable than by using meaningful material (Egan, 1948).

Nonsense syllables have the disadvantage of being unfamiliar to the listener. They are often abstract and are very confusing to the listener (Carhart, 1965).

They need special training to be read out in the intended way (Egan, 1948), Lagon, J.C.(l966) found in practice that nonsense syllable are not easy to use because the subject has an unconcious tendency to look for meaning in the sound presented to him and to reproduce it as a known term. So it was felt preferrable to choose words which had meaning. The data of Zekrzewski et al (1975) sugges that nonsense words would test only recognizability of the subject which is a subcortical phenomenon. The discrimination of speech whi< is a cortical function can be tested with monosyllables if they are meaningful words.

Words;

Another approach to discrimination testing was the use of multiple choice words. In this procedure printed groups of phonetically similar words were shown to the listener but he hears and is to respond to only one word from each grouping. An advantage of this approach is that words of more than the single syllable may be used so long as each grouping contains words of the same syllable length and stress pattern. Another advantage is that these tests were a closed response set.

Black J.W (1963) developed a multiple choice word intelligibility test. Other tests developed in this category with some modification are the rhyme test by Fairbanks (1958) and the vocal

communication lab test by Hager (1946). The Rhyme test was designed to emphasize auditory phonemic factor and to minimize linguistic factor. It somewhat resembles a multiple choice word test. The stimulus words in the Rhyme test were drawn from a vocabulary of 250 sets of 5 rhyming words each. One word from each set was read to the subject. On his response sheet were given the fifty stems with a space in front of each where the subject inters on latter to complete the spelling of the word he believes he heard. But some investigators are against the use of words as test material. According to them use of single words especially single syllable words imposes severe limitations on the capacity to manipulate a crucial parameter of ongoing speech, its changing pattern over time. In order to add this dimension to speech audiometry, it is necessary to develop materials based on relatively longer samples of speech than words.

Monosyllabic words:

Monosyllabic words are ten analytic units of speech so are more easily repeated than nonsense syllables. So many researchers, preferred to use monosyllabic words. Attempts was made to balance the sound in any one list according to their normal frequency of occurrence in normal conversational English, called 'phonetically balanced lists or PB lists'.

Carhart (1965) recommended the use of monosyllabic words for discrimination test since they are meaningful to the subject and nonredundant. The multitude of cues present in a sentence or poly-

syllabic word may enable him to correctly guess the correct response thus could obscure speech discrimination difficulties of a subject. According to Egan (1948) one of the advantage is they do not need special training to be read out.

Egan et al (1948) developed a series of tests at Harvard University to assist in the assessment of intelligibility. These lists were known as PB-word lists. From an original sample of twelve hundred monosyllabic words twenty list of fifty words each were constructed. They are known as PAL PB-50 lists. The words such selected meets the following criteria.

a) monosyllabic structure.
b) equal average difficulty.
c) composition representative of English speech and
d) words in common usage.

These lists were judged to be of equal difficulty.

Later Hirsh et al (1952) modified these tests at the Central Institute for the Deaf were available for clinical use as W-22. Tests of CID the modifications were made to overcome the shortcomings of the first test. The major deficiencies were difference between lists and extensiveness of the vocabulary.

Harvard PB lists were phonetically balanced. Although investigators of PAL give more importance to familiarity, the lists were found to contain many unfamiliar words (Hirsh et al 1952). The CID W-22 lists were found to be easier than the Harvard PB lists. This

difference has been attributable to the greater familiarity of the words and speaker intelligibility (Owens 1961; Guetzinger, 1972). However, the utility of W-22 was limited. Hirsh et al (1952) themselves pointed out that this list does not satisfactorily separated mixed hearing loss from conductive hearing loss patients. The older recording of Egan lists are effective in this respect.

Lehiste and Peterson (1959) made a realistic approach to the problem of phonetic balance, they attempted at phonemic balancing rather than phonetic balancing. They selected monosyllables of CMC (Consonant-nucleus-consonant) composition the Lehiste and Peterson lists and the Harvard PB lists give comparable results (Carhart, 1965) although differ in terms of criterion used. (Harvard list consisted of CV and VC type combination while Lehiste contained only CNC combination).

North Western University Test number 4 (Tillman and Carhart and Wilber, 1963) and test number 6 (Tillman and Carhart, 1966) were developed later using CNC monosyllabic words and were phonetically balanced. Later multiple choice tests, rhyme test and modified rhyme test were developed. The Kensar University developed the K.U Speech discrimination test. These emphasized the auditory phonemic factors and minimized the linguistic factors.

Later it was felt that the use of single words especially single syllable words imposes severe limitations such as vocabulary,

relative range of difficulty, meaningfulness which acts as variables and imposes a limitation on the parameters of speech and its changing over time. So the National research council on Hearing and Bioacoustics found the monosyllables as not a proper representative of everyday speech and suggested the use of sentence as material for speech audiometry. Sentences are considered to be more valid indicator of speech.

In case of SRT testing, spondaic words are most widely used test stimuli and monosyllabic words in case of speech discrimination testing (Carhart, 1970).

SRT and Pure tone averages:

There is a high positive correlation between PTA and SRT. So some authorities feel that it is not necessary to determine SRT (silverman and Hirsh, 1955). However any discrepensy between PTA and SRT is important for determining accuracy of both PTA and SRT Martin (1958).

For all practical purposes the average pure tone result for 500, 1000 and 2000Hz has been the most popular for predicting a relationship between pure tone and spaach thresholds (Hopkinson, 1978). Studies by Fletcher (1950), Carhart and Porter (1971) revealed that the average of the two smallest threshold levels among the three speech frequency is also clinically found to be useful.

Carhart (1971) proposed the following formula to predict the speech reception threshold from pure tone average, when the audiometric contour is not taken into account and when the testing equipment is calibrated to ANSI reference levels.

SRT spondee= -2dB +0.5T 500Hz+ 0.5T 1000Hz

(The 2 dB is a minor correct constant).

Gjaevenes (1964, 1974) used regression equation to predict the SRT. He found a linear relationship between SRT and PT HL He proposed the following formula for predicting the SRT from pure tone hearing levels. Accordingly:

SRT = 0.8 + 0.34 HL (.5) + 0.12 HL (1) + 0.34 HL (2) + 0.15 HL (3)

His method is more accurate then simple averaging method of three frequencies (viz. 500, 1000, 2000Hz). He also found that cochlear hearing loss cases yield somewhat lower SRTs than conductive hearing loss cases.

According to Jerger et al (1959) the relationship between the puretone average and SRT vary depending upon kind of speech threshold investigated, type of test material used and method of testing.

The interdependence of SRT and PTA become poorer at higher frequencies. If the notch is present is present beyond 2048 Hz* it is difficult to differentiate it from flat loss (Carhart 1946). It was also found that acuity between 512 Hz and 0124 Hz more clearly related to speech reception for equated words than is acuity between

1024 and 2048 Hz. Davis (1948) reported the average of the threshc for 500, 1000 and 2000Hz as 9 dB (SPL), at the same time he gave threshold for various speech stimuli which ranged from 22 dB for spondees through 26 dB for sentence material and digit to 33 dB for words as spoken by Rush Hughes.

A survey by Glorig et al (1954) revealed a difference of 15 dBSPL between threshold value at 1 KHz and spondee words for all ears in the selected normal group. A similar observation was made by Carso (1957) although he employed a different criteria for selection of subjects. He reported a difference of 14 dB SPL betwee the threshold for PT and for SRT obtained using CID auditory test W-2.

Lightfoot et al (1956) on studying 31 otologically normal subjects observed a 16.5 dB difference between the threshold for 1 KHz and for spondee words.

Carhart and Porter (1971) established the effects o± audiometric onfiguration on the relationship between pure tone threshold and spondee threshold. It was found that 1000 Hz was a good predicto of SRT. Adding a second frequency improved the accuracy of prediction slightly. This second frequency varied with audiometric configuration. Adding a third frequency did not produce any practical improvement in predictability for SRT. Thus, it was indicated that the audiometric pattern influences the threshold for spondees.

There are various factors which influence measurement of speech threshold and discrimination ability. Some of them are discussed under the following headings:

Recorded or Live Voice Presentation:

Either recorded or monitored live voice technique can be used to obtain the speech threshold. However ASHA recommended recorded presentation as a preferred procedure.

Recorded material have the advantage of greater standardi-zation and results from one centre to another can be easily compared. It reduces intra-inter test variability and allows for the control of uniform intensity of the test words. It ensures that each test word will be presented in the same manner to every client. However, recorded material also have some dis-advantages. The clinician may have to stop the recording to permit the client to respond to the test word before the next one is presented. Disc and tape recordings will show wear after a period of use and introducing distortion of the signal and noise into the test system. Thus situations may arise which favour the use of a monitored live voice presentation. The flexibility of live voice testing allows the clinician to fit the test to the need of the patient which is not present in the recorded method. But some of the disadvantage of live voice is that, it is difficult to monitor the test words to a consistent intensity level and it may not be possible to present each spondee in the same manner to every client.

O'Neill and Oyer (1966) found not much difference between live voice and recorded SRTs.

A study by William T Brandy (1966) showed that the recorded presentation are more reliable than live voice presentation as greater variability is involved in the talker's presentation. However Portman and Portman (1961), Geston et al (1966) were in favour of live voice technique as it permits greater flexibility in the clinical procedure.

Descending Vs Ascending Method:

Martin and Pennington (1971) reported that bracketing was the most widely used method to establish SRT. The second largely used method was descending steps. Ascending steps was used by few audiologists.

A few investigations are mainly concerned with a method of using 5-dB step or 2 db steps in the SRT, also dealt with a descending or ascending method.

Chaiklin ana Ventry (1964) using a descending technique showed no significant difference in SRT between a 2 and 5 dB step. Chaiklin Font and Dixon (1967) using an ascending technique and 5 dB steps demonstrated that SRT was a valid and reliable procedure. However the authors also pointed out that the descending procedure may be more useful among young children and those persons who do not understand the instructions well.

A study by Robinson and Koenigs (1979) reported that slightly lower speech thresholds resulted from the use of a descending procedure.

According to Hopkinson (1978) there is no clinically significant difference in SRT obtained using ascending and descending technique.

Familiarity:

A word becomes familiar depending upon the frequency of use by word count. Black (1952) reported that even among the common words more familiar words are more intelligible than other words.

A study on the relationship between the intelligibility of scores and frequency of occurence of words by Howes (1957) revealed that repetition of the list will result in increased intelligibility scores.

Tillman and Jerger (1959) demonstrated that the short term practice in the task of responding to spondees at threshold intensities does not influence spondee threshold SPL in normal hearing subjects. However, when the prior knowledge of the test vocabulary was given threshold was lowered by 3-5 dB compared to subjects of which such knowledge was not given.

The spondee thresholds established after familiarization were not only lower in the mean SPL values but also were less variable

upon repeated testing (Jerger et al 1959; Tillman and Jerger, 1959). Thus familiarization with test spondee was considered to be important step during establishing the spondee thresholds. Over (1961) has also observed that if a word is more familiar it is more intelligible.

H.J. Cyer and M.Duudna (1960) concluded in their study that discrimination losses decreases when the task is presented a second time.

Elmer Owen's (1961) study on the intelligibility of words varying in familiarity shows that tests characterized by greater familiarity even to a slightest degree were significantly more intelligible.

According to Carhart (1965), unfamiliar materials tend to make the test more difficult. It does not mean that highly familiar words must always be used since there are times when a relatively difficult test is preferable.

Conn Dancer and Ventry (1975) constructed a list of spondees selected from the CID W-I test to eliminate the need of familia-rization. The list so constructed produced spondee tnreshold equivalent to those obtained with familiarization. This result further substantiate the important influence of familiarity on SRT.

Homogeneity of Intelligibility:

Homogeneity is important to obtain precision in estimating the level at which 50% of the items are identified and to use as

few items as possible to obtain the SRT (Hudgins et al 1947).

Ideally, a SRT list should be homogeneously intelligible. Homogeneity can be achieved either by selecting only those words that tend to reach the listener's threshold at the same intensity level or by recording individual words in such a way that they all tend to be heard at the same level of reproduction (Hudgins et al 1947).

The spondees gain function is steeper than that of the PB word lists. Its average slope between 20 and 80% is<bout 10% (Hirsh 1952). The steepness of the gain function can be changed by manipulating the homogeneity of a list with respect to inteili - gibility.

Carrier Phrase:

Egan (1944) and Carhart (1952) utilized carrier phrases in speech audiometry with the intention of alerting the listener for the test word and allowing the announcer to monitor his voice. The exact content of the carrier phrase was not given much consideration.

Kruel et al (1969) found significant differences in scores as a function of carrier phrase.

Gladstone and Siegenthaler (1971) studied the possible diffe- rence in intelligibility as related to different carrier phrases. They conclude that the intelligibility with the phrase 'you will

say' was best perhaps because of the long vowel /ei/ at the end, in contrast to other endings has a greater potential for being influenced by the phonemes of the word to follow and thus give additional cues to intelligibility.

Lynn and Brotmen (1981) have postulated that the phrase 'you will say.....' contains perceptual cues that enhance identification of place of articulation of the initial consonant of the test word.

In controversy to above findings, Martin et al (1962) discussed the nonessentiality of the carrier phrase and said that it only confused the listener who had severe discrimination problem. Nixon (1969) also has reported that carrier phrase does not have any effect on the intelligibility of words.

Considering the findings of these different investigators it seems justified to maintain using a single carrier phrase through all discrimination testing.

Phonetic Balancing:

Phonetic balance lists of words consist of a group of single syllable words so selected that the frequency of occurance of speech sounds within the group is same as the frequency of occurence of the same sounds in an average vocabulary of conversational language material.

Fletcher's (1965) data of relative frequency of occurence of English phonemes in telephone conversation was widely used.

Black and Heagen (1963), Lafer J.C (1966) argue that one should no longer choose the words on the basis of a phonetic balancing of the word list but on the basis of the information they carry.

Studies done by Carhart (1965) showed that difference in phonetic balance among lists are of only secondary influence as long as these are only moderate difference.

Carhart (1970) reported that precise balancing does not seem to be major importance from the clinical point of view.

Berjer (1971) argued well that any sizable sample from conversational vocabulary would be by definition and phonetically balanced sample of spoken English.

Studies done in India:

Research was done on 'Adaptation of Speech Test Material in English to Indian conditions' by Nikam (1968). She combined the words from W-22 and children's spondee list and administered to seventytwo undergraduates in Mysore for familiarity ratings. Out of eighty words, fortyfive words were rated as very familiar by seventy percent of the subjects. These words were intended to be used with those cases with a minimum of high school education.

Abrol's (1971) study on the development of spondee and phonetically balanced word lists in Hindi was one of the early advances in India with regard to speech audiometry. His study was based on the frequency analysis of the speech components and familiarity. Yet it faced some drawbacks as:

1) it did not include practice effect;
2) SRT level not mentioned and?
3) articulation curves were not given.

Kapur (1971) developed Hearing and Speech test material in Tamil, Telugu and Malayalam. In the construction of these tests excepting for the nature of materials used their method of selection, methodology were similar for all three languages. In Malayalam languages. Disyllabic words were used for both SRT and PB word lists as very few monosyllables woras were available in the language.

In Tamil language though he suceeeded in collecting the familiar monosyllables, the list failed to represent all the sounds which do occur in Tamil language and are used an distinctive feature in the perception of speech in today's Tamil (Somasundaram 1973).

Some of the limitations of Kapur's(1971)study were that :

1. practice effect was not taken care of:
2. SRT level was not mentioned?
3. disyliables were used in placed of monosyllable (for Malayalam).

An attempt has been made by Swarnalatha (1972) to standardize spondee and PB word list in English on Indian population. However this test is meant only for literates.

Nagaraja (1973) developed a synthetic speech identification test in Kannada language.

Later De N.S (1973) developed spondee and PB word list in Hindi and claimed that it could be used all over India. But this test cannot be administered to non Hindi speaking population awing to unfamiliarity and language barrier. Also the test validity was not determined.

An attempt was made by Maya Devi (1979) to construct a speech discrimination test could be used with the speakers of all Indian languages.

Dayalan (1976) developed PB word list in Tamil language. The list yielded similar results like any other valid test of discrimination.

Rajashekhar (1976) developed a picture SRT test for adults and children in Kannada. The articulation function for this word list extended over 30 dB. Hence words were not considered homogeneous.

An attempt was made by Malini (1981) to standardize NU Auditory test No.6 on English speaking Indian population. The population she tested was limited to those subjects who are proficient in English language.

Hemalatha (1981) developed a SRT test in Kannada for children. Picturable polysyllabic words were used as stimuli. The children tested were in the range of 3-5 years and the mean SRT was found to be 11 dB HL. The test was standardized only on school children so its validity with other group of children has to be established.

Asha (1983) studied effect of word familiarity on speech discrimination scores and found that words that were highly familiar were correctly discriminated more frequently than those which are less familiar. And listener familiarity of the test words had no influence on their discrimination scores, when words are presented at different intensity levels.

Mallikarjuna (1984) developed spondee and monosyllabic word list in Gujarathi language.

Rangamani (1984) constructed bisyllabic word list in English from the common vocabulary of Indian English and standardized to different language groups. She claims that this test could be used with people from different language background and also those who have no formal education in English. But the study was restricted only to Kannada and Tamil languages.

METHODOLOGY

METHODOLOGY

The purpose of the present study was to develop and standardize SRT and discrimination test materials in Manipuri language.

The study consists of three folds:

1. to obtain familiar polysyllabic and monosyllabic (CVC) words.
2. to construct lists of polysyllabic and monosyllabic words.
3. to standardize the above lists using Manipuri speaking adult subjects.

Procedure:

Procedure of Familiarity:

Familiar polysyllabic and monosyllabic words were selected from different sources such as phonetic reader book, magazines, books and normal conversational speech. This resulted in a collection of 415 polysyllabic words and 231 monosyllabic words. To ensure familiarity, the above lists were given to ten normal adult subjects whose mother tongue was Manipuri. They were asked to rate the words in a three point scale of familiarity (not familiar, familiar and most familiar).

Construction of the lists:-

The words which were rated as most familiar were collected and from them 80 polysyllabic words and 100 monosyllabic words were chosen for the construction of present lists. Four lists were

developed for each type of words - polysyllabic word lists contained 20 items each and monosyllabic word lists contained 25 items each. Each list was randonized into six lists to avoid practice effect due to repeated presentation.

Recording procedure:

The lists were recorded in a sound treated room. Philips casette tape recorder was used.

The recording was made by an adult female talker (the investigator) whose mother tongue is Manipuri. She had four years experience in the monitored live voice technique of speech audiometry. All the test items were recorded proceeded by a carrier phrase "[illegible]" . The items were spoken with an interstimulus interval of 5 seconds. At the beginning of each list, a 1000 Hz calibration tone was recorded. The level of the tone was adjusted so as to produce a 0 VU deflection on the meter.

English spondees and PB materials of Swarnalatha (1972) were also recorded in a similar way by the same talker. A carrier phrase 'say the word' was used for both spondees and PB materials.

Subjects:

Five Manipuri speaking graduate students served as subjects (3 males, 2 females). All the subjects had normal hearing (20 dBHL ANSI 1969) with no history of ear discharge or ear infection. All the subjects knew English.

Standardization of SRT test materials:

Four lists of 25 items each were used. Each list was presented at various intensity levels of 5 dB interval such as 0, 5, 10, 15, 20 ana 25 dBHL (with reference to 0 dB SRT of the audiometer) Each list was randomized into 6 lists and each randomized list is presented at only one intensity level. Instructions were given to every subject to respond to the test words only. A time gap of 5 seconds was given to the subject to respond. Responses were noted down by the examiner and these were converted into percentage score (each word having weightage of 5%) for further analysis.

The level at which the subject repeats correctly 50% of the test items was taken as SRT level.

Standardization speech discrimination test materials:

Four monosyllabic word lists of 25 items each were used. Each list was randomized into five lists to change word order - thus avoiding practice efrect. The lists were administered at intensity levels, 5, 10, 20, 30 end 40 dB above subject's established SRT. Responses were noted down in the seme manner as it was being done for polysyllabic words.

Recording of Responses:

A talk back system was used for the subject's response. The subject repeated the word and the examiner recorded the correct

response. These were converted into percentage of correct responses at each intensity level for further analysis.

Validity of Test:

To check the validity of the test materials comparisons were made between present test items and validated English test materials. The latter was also administered to the same subject.

Plan of Analysis:

The familiarity ratings of the monosyllabic and polysyllabic words given by 10 adult subjects were analyzed for selecting the most familiar words using 75% criteria.

The mean values of the percentage of correct responses were calculated for each list and articulation curves were plotted.

RESULTS AND DISCUSSIONS

RESULTS AND DISCUSSIONS

Articulation function tor the four polysyllabic word lists are given in fig (1-4). From the table-1 it is clear that the percent of correct response increases with the increase in sensation level.

The slopes of the articulation function are 5.27%/dB (List-A), 4.93%/dB(List-B), 5.67%/dB(List-C) and 5.8%/dB(List-D) with a mean of 5.41%/dB between 5 and 15 dBHL.

In the present study, the mean SRT level is attained at 13 dBHL (ref 0 dBSRT) which is in close agreement with pure tone average of 11.34 dBHL. The difference between PTA and SRT for different lists are given in the table-3. Fig.(5) shows comparison of the different word lists and on inspection it is found that all the four lists are essentially equivalent and yield essentially similar scores at all sensation levels.

Discrimination scores obtained using monosyllabic words are given in the figs(6-9). Here also, percent of correct response increases with the increase in sensation level. Maximum discrimination score was obtained at 40 dBSL(ref SRT). This is in close agreement with other findings. Abrol (1971) obtained 100% articulation score using Hindi PB words at 30 dBSRT, Kapur (1971) using Malayalam words obtained 100% discrimination at 45 dB(relative intensity) and at 44 dB (relative intensity) using Tamil words. Dayalan

(1976) obtained 100% discrimination score at 35 dBSL (ref SRT) using Tamil words. Mayadevi (1974) at 30 dBSL (ref PTA) using English words and Swarnalatha (1972) at 33 dBSL (ref. SRT) for adults and 36 dBSL(Ref SRT) for children using English word lists.

So in the clinical situation the speech discrimination test has to be administered at 40 dB above SRT. Fig.10 shows comparison of different lists.from it, it is observed that all the lists are essentially equivalent so they can be used inter-changeabily.

To check the validity of the present lists, a comparison was made between the present list and English SRT and PB word lists of Swamalatha (1972) (considering the letter to be a valid test). The English lists were administered on three subjects. The comparisons are given in the fig (5) and fig (10) respectively. It is demonstrated that both the test yield almost similar results insuring external validity of the present list.

Table-1: Mean discrimination scores(%) at different sensation levels for the lists A to D.

Sensation level in dB (ref.SRT)	MEAN VALUE IN PERCENTAGE			
	List A	List B	List C	List D
5	22.4%	30.4%	28%	28%
10	62.4%	59.2%	68.8%	56.8%
20	86.4%	86.4%	86.4%	80%
30	94.4%	96%	96%	90.4%
40	99.2%	100%	98.4%	99.2%

Table-2: Showing Mean of the percentage of correct polysyllabic words at six hearing levels.

Hearing level in dB	Mean Values in Percentage			
	List A	List B	List C	List D
0	1%	0%	0%	1%
5	5%	12%	7%	8%
10	33%	27%	26%	38%
15	59%	64%	59%	70%
20	84%	86%	92%	95%
25	91%	97%	99%	98%

Table-3: Showing difference between SRT and PTA for different lists

List	Subjects					Mean difference
	1	2	3	4	5	
List A	6.3	1.2	1	3.7	0	2.44
List B	1.3	4.2	5.5	0.3	3.5	2.96
List C	6.3	0.7	3.5	0.7	0.5	2.34
List D	3.3	5.7	4	3.2	1.5	3.54

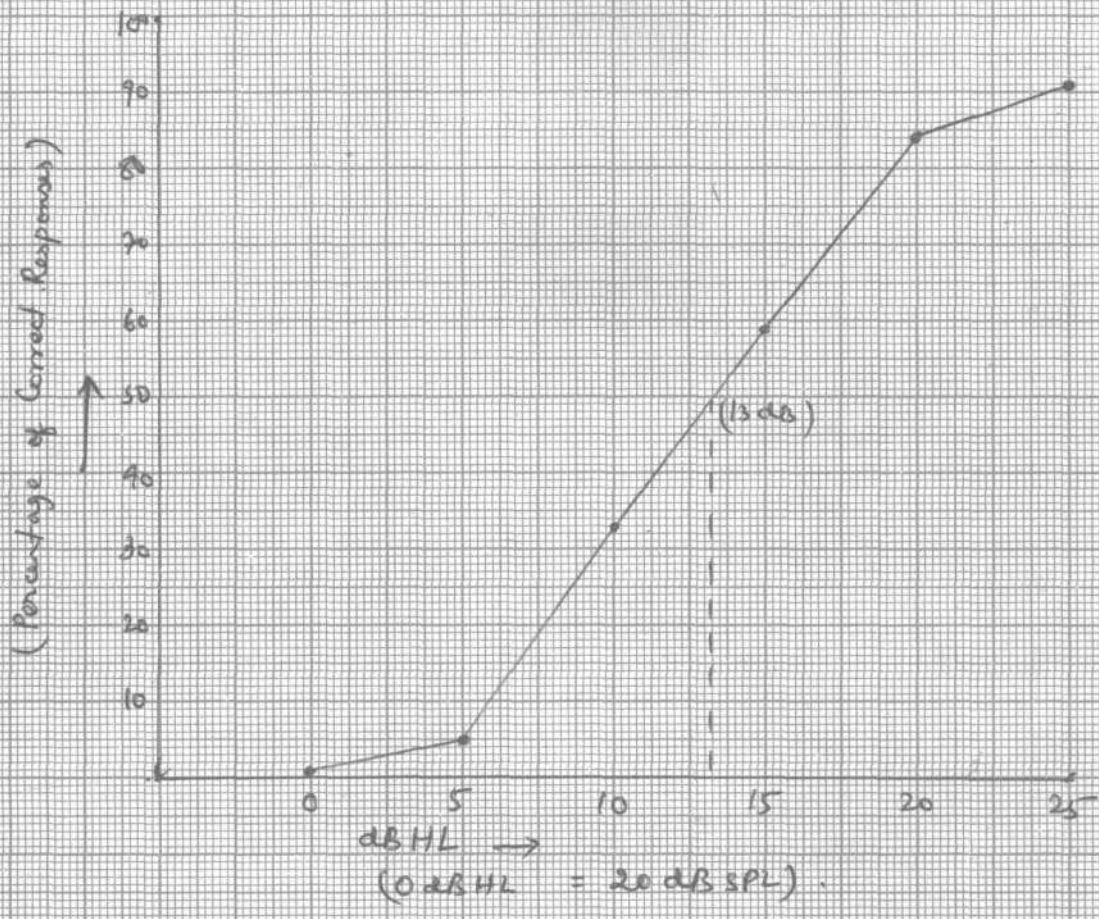

Fig-1: Showing mean articulation curve for polysyllabic words (List-A)

Instrumentation:

A 2-channel diagnostic audiometer Beltone 200-C (Calibrated at ANSI standard) and a cassette deck (Philips) were used. The recorded words were played by the tape recorder and was fed to the tape input of the audiometer which in turn fed to the ear-phone (TDH-39) coupled with Mx-41/AR ear cushion. The objective calibration of the audiometer was made using B&K equipment (artificial ear B&K type 4152, Sound Level Meter B&K type 2203, Octave Filter B&K 1613 and 1" condenser microphone B&K type 4144) in a soundtreated room. Routine daily check was also made.

Test environment:

The study was conducted in a two room situation sound treated room, one served as control room and other as test room. The noise level is the test room was measured by using a sound level meter B&K type 2203 with octave filter set B&K type 1613, and a 1" condense microphone B&K type 4144. The obtained values were given in the Appendix-V. It is to ensure that the noise level of the audiometric room is within permissible limits.

Test Procedure:

Pure tone thresholds at 500, 1000 and 2000Hz were obtained for each subject prior to actual testing using up 5-down 10' method of threshold measurement (re David S.Green).

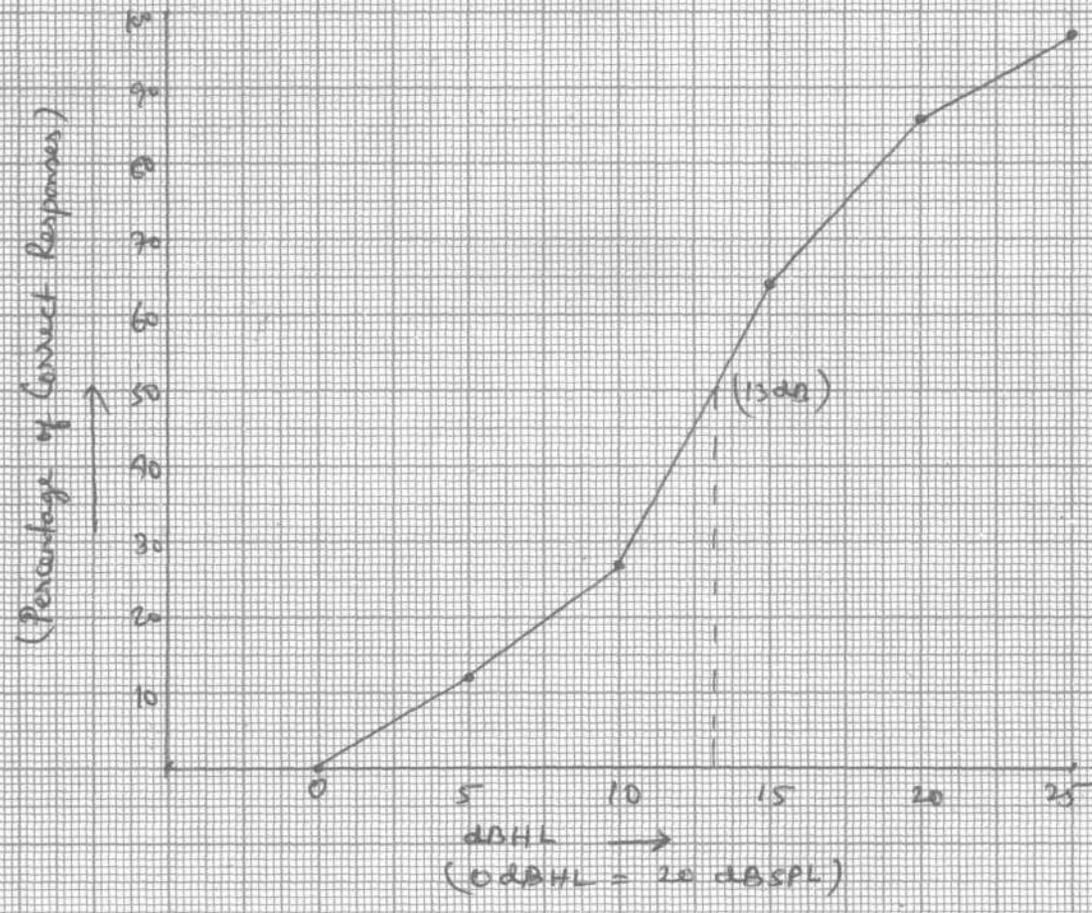

Fig.2:- Showing mean articulation curve for polysyllabic words (List-B)

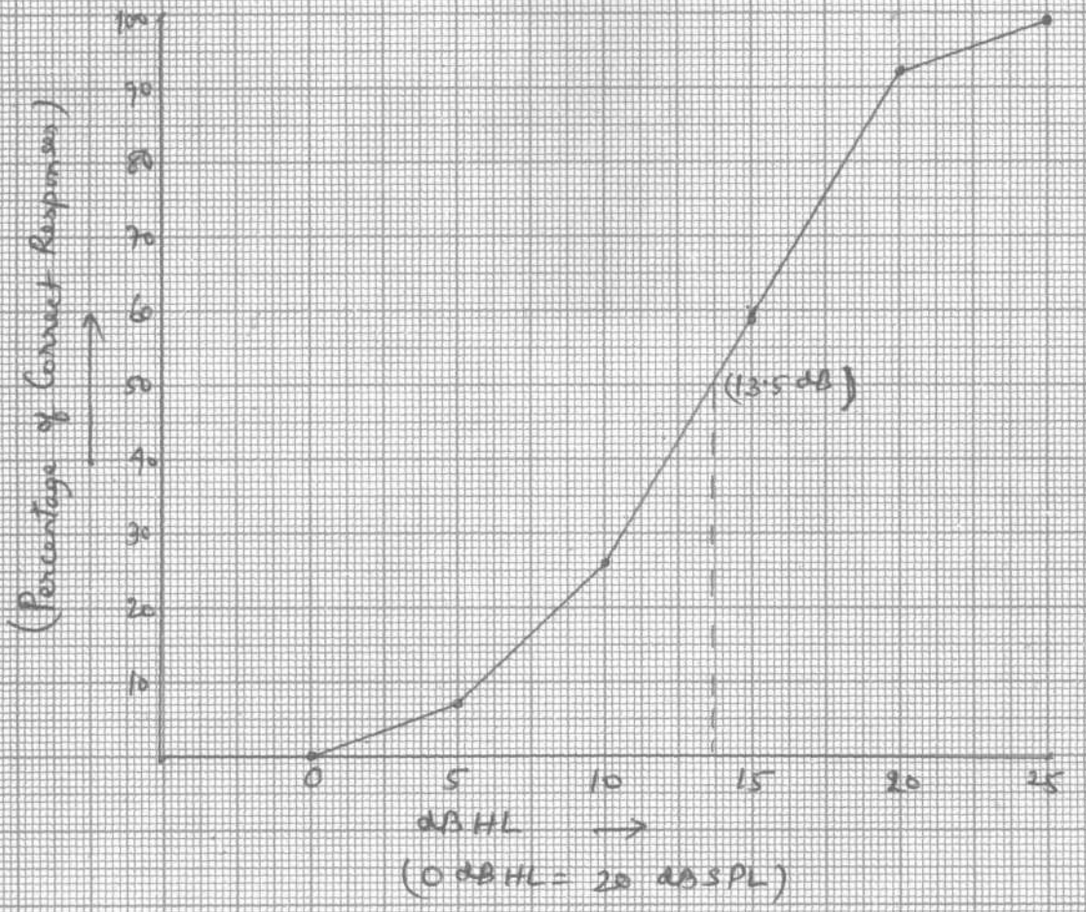

Fig.3: Showing mean articulation curve for polysyllabic words (List-I)

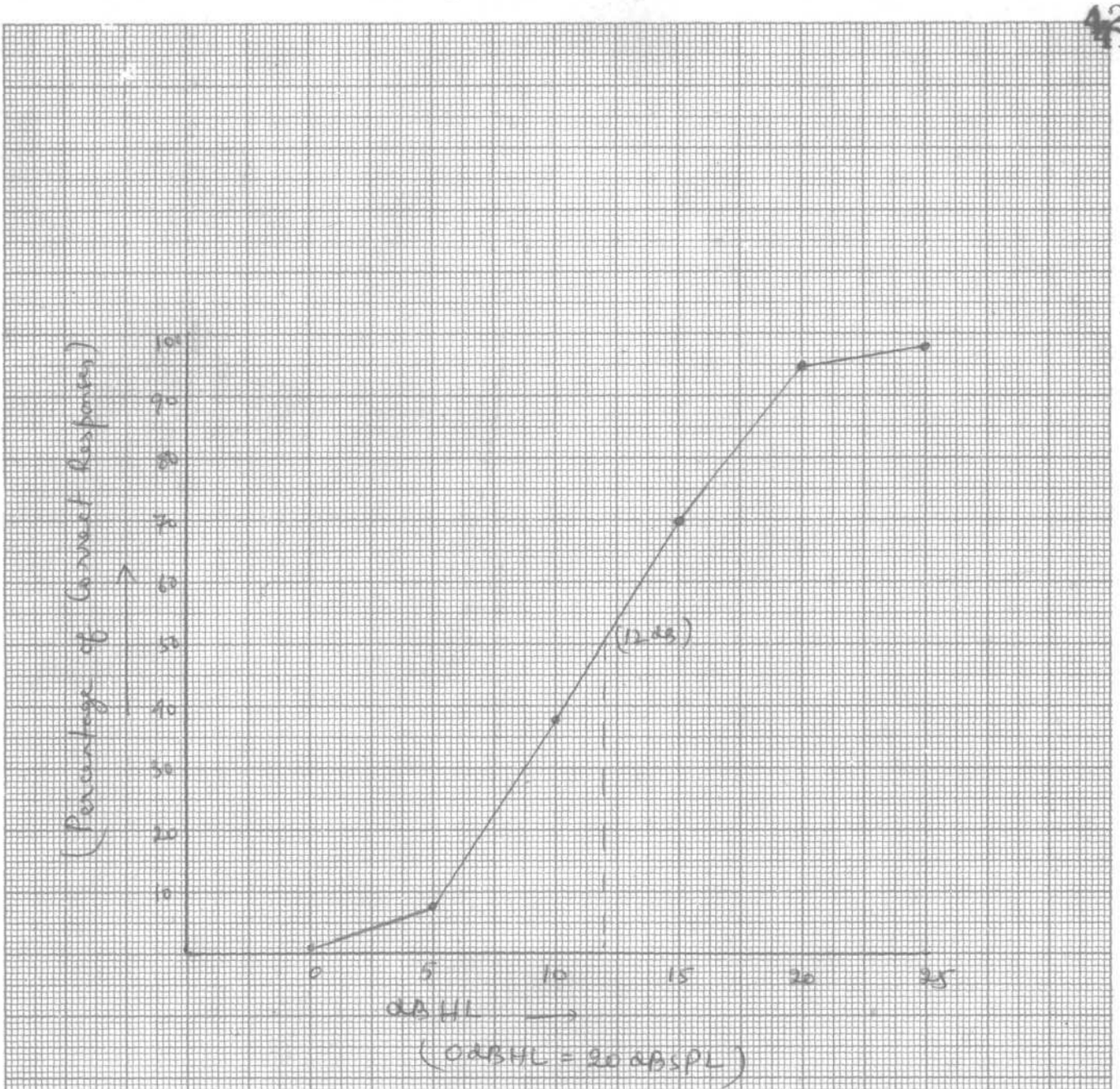

Fig.4: Showing mean articulation curve for polysyllabic words (List-D)

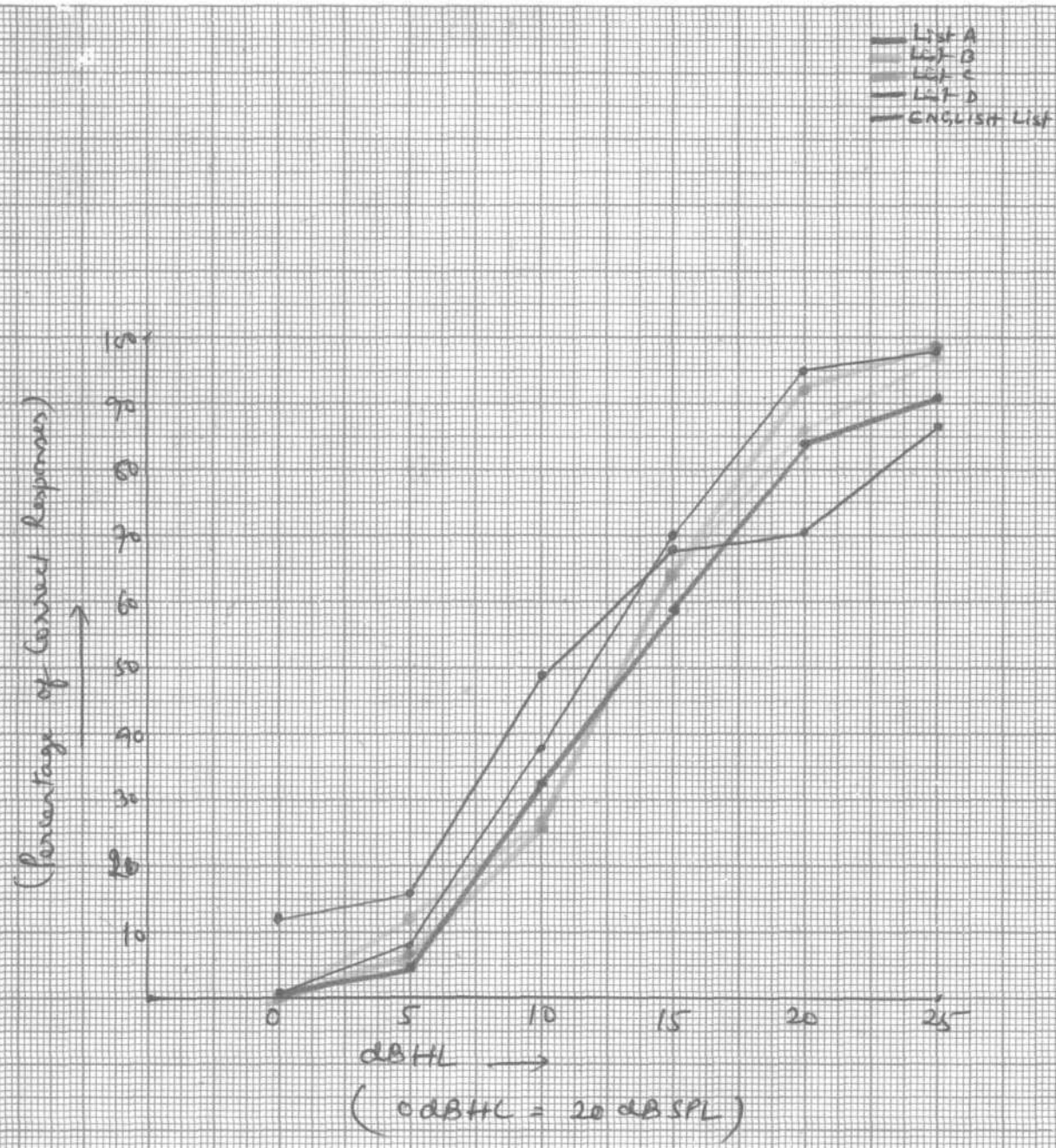

Fig.5: Showing articulation curves of polysyllabic words (List A-D) and English list.

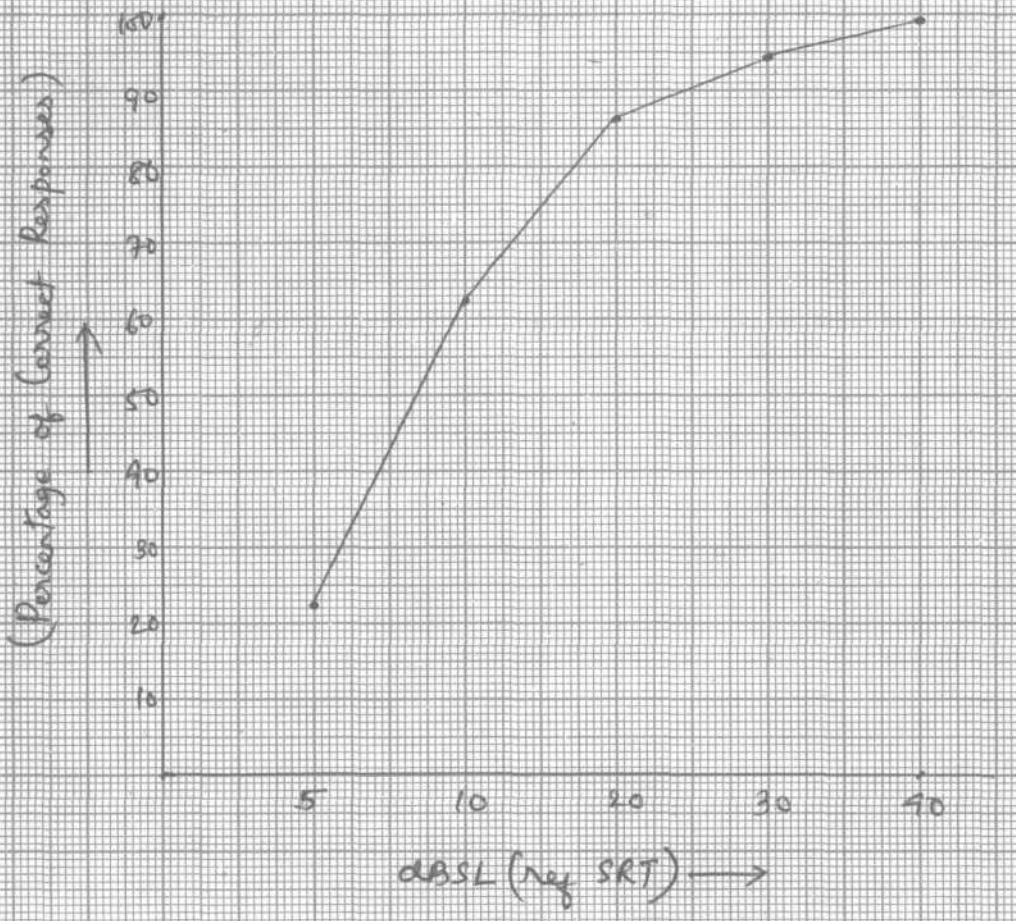

Fig.6: Showing mean articulation curve for monosyllabic words (List A)

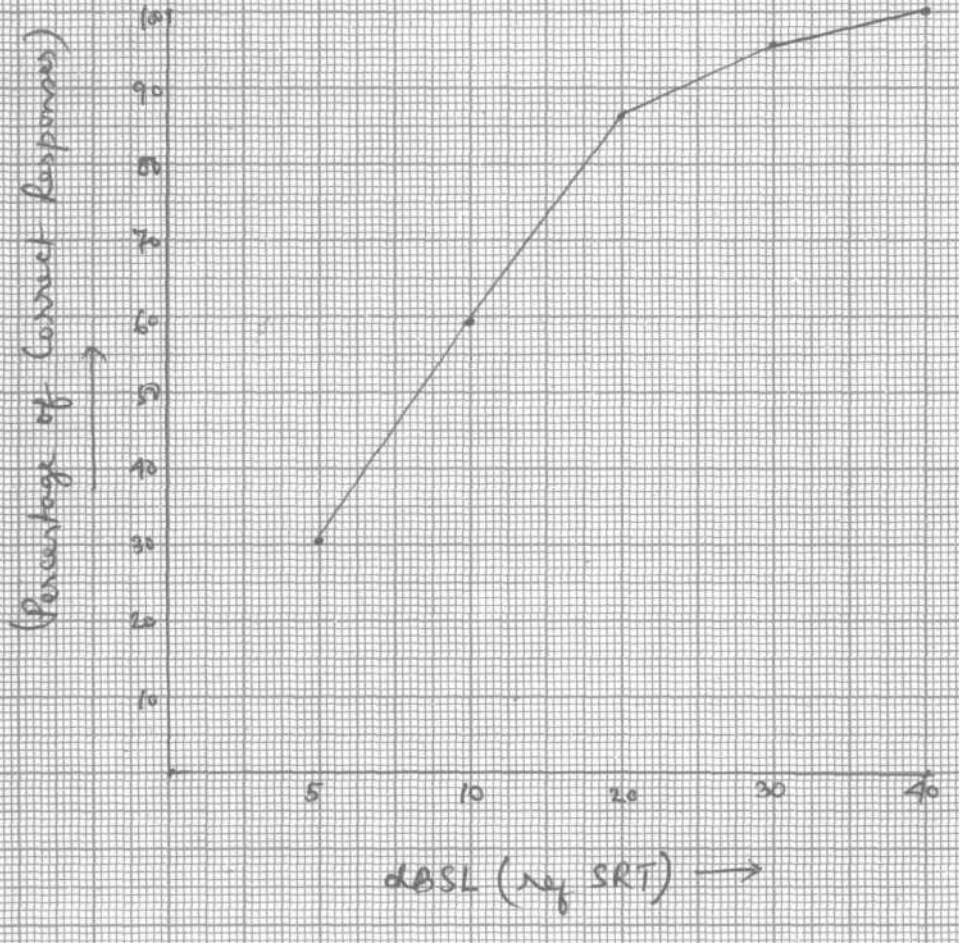

Fig.7: Showing mean articulation curve for monosyllabic words (List-B)

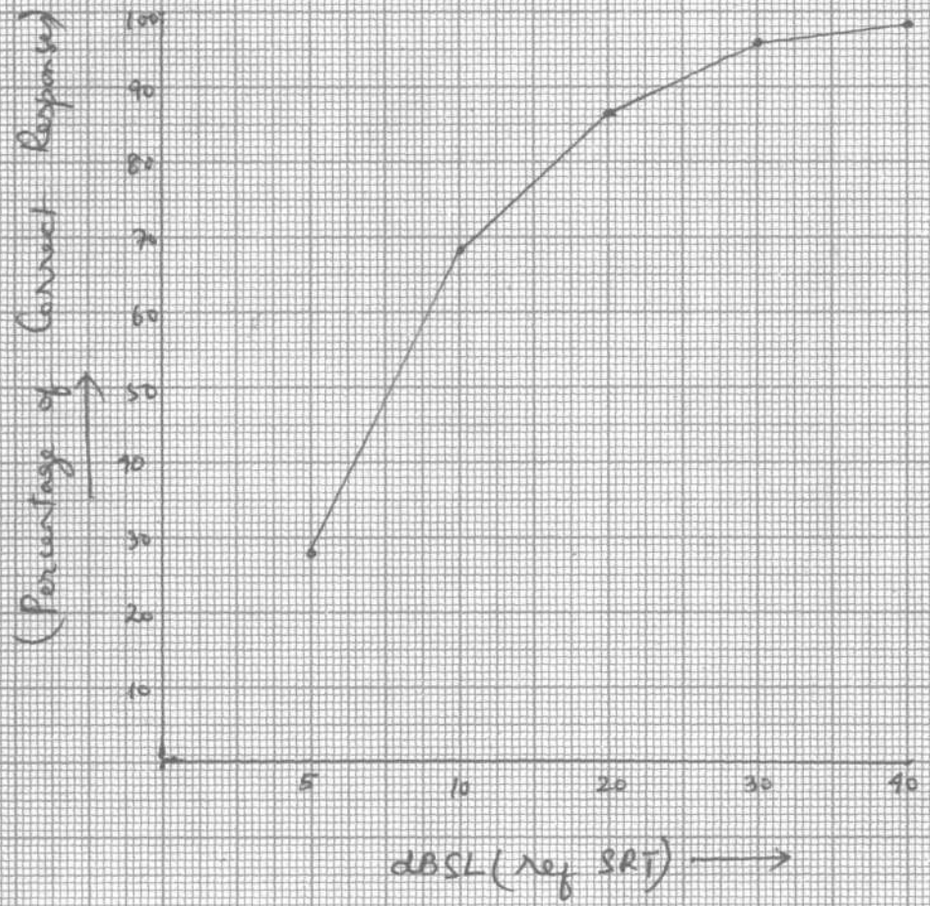

Fig-8: Showing mean articulation curve for monosyllabic words (List C)

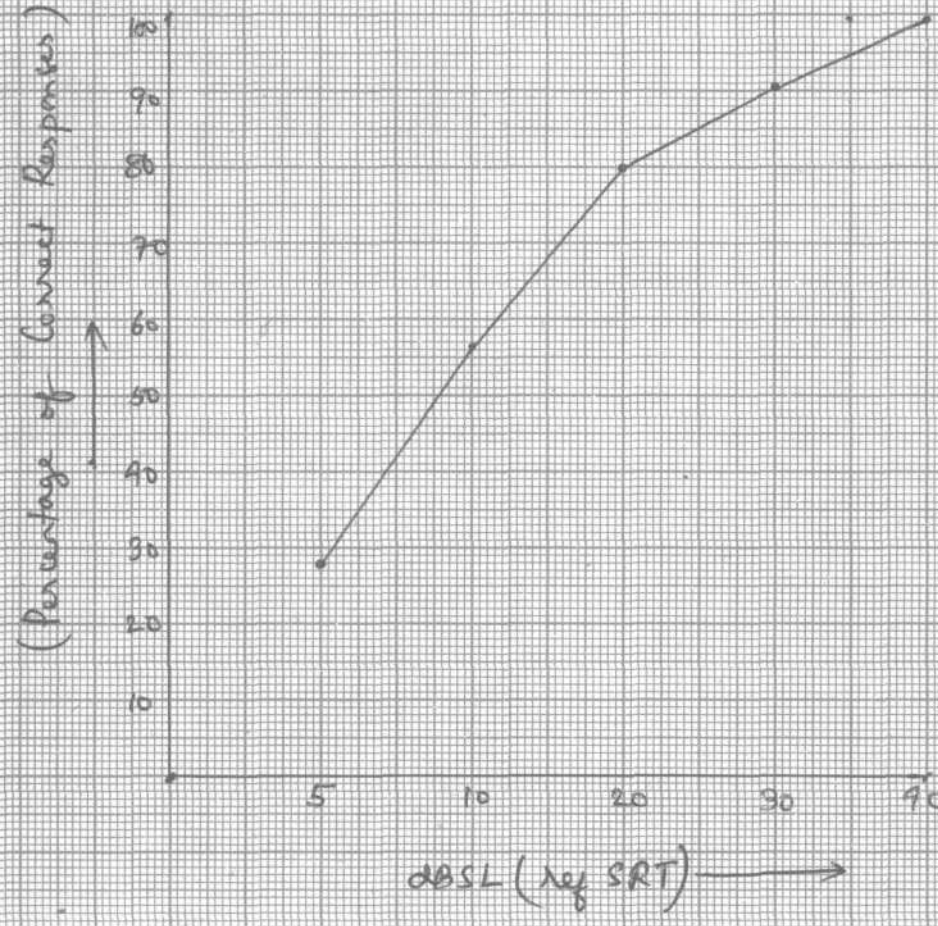

Fig-9: Showing mean articulation curve for monosyllabic words (List D)

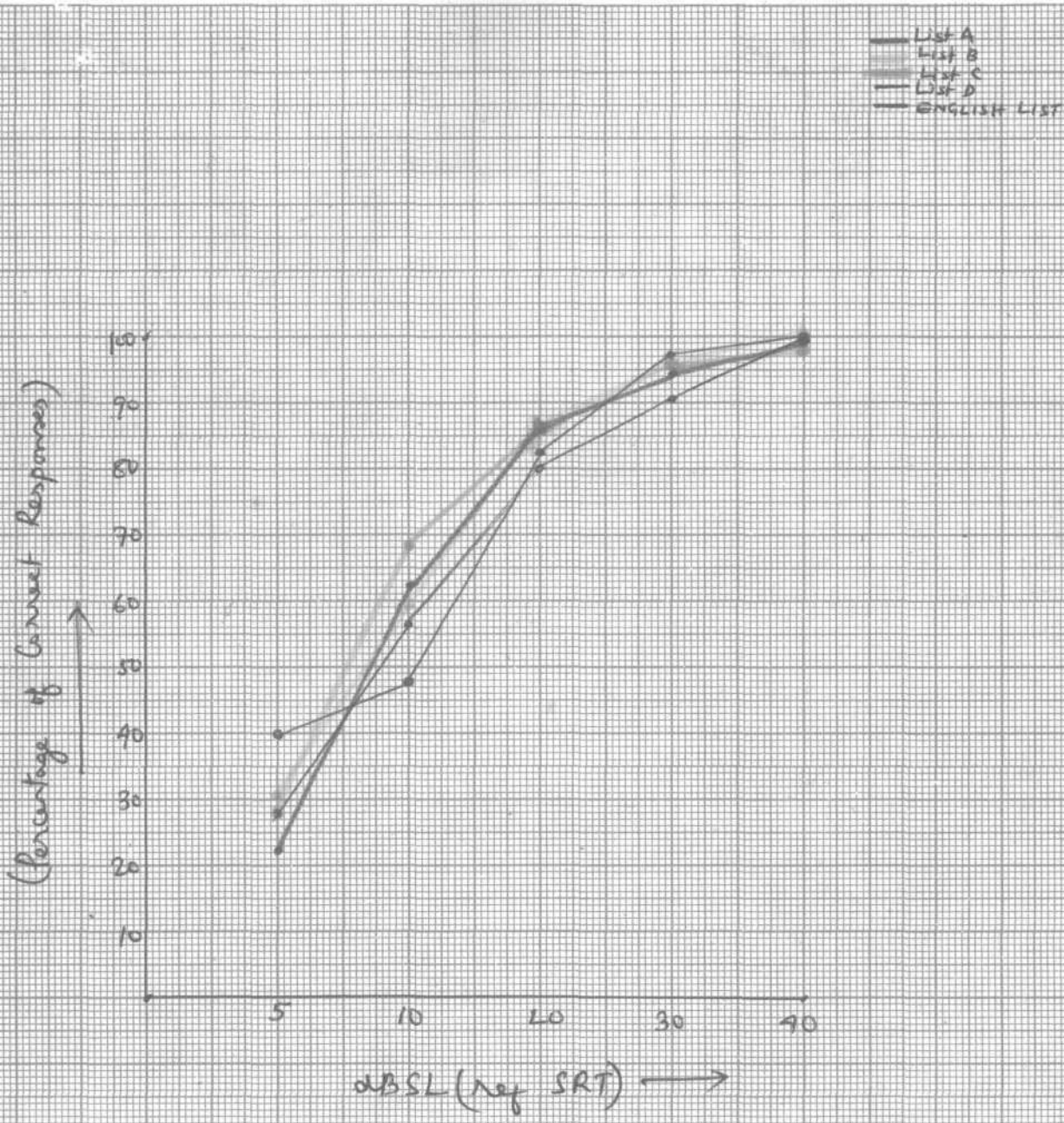

Fig.10: Showing articulation curves of monosyllabic words (List A-D) and English list.

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

The aim of the present study was to construct and standardize SRT and speech discrimination test materials in Manipuri language.

Monosyllabic and polysyllabic words from various sources such as books, magazines, newspapers and normal conversation were administered to 10 adults for familiarity testing. The most familiar words were selected to form four polysyllabic list each one containing 20 words and 4 monosyllabic word lists of 25 words each. The monosyllabic words are not phonetically balanced as studies are not available.

All the test materials were tape recorded and fed through the speech channel. Five adults comprises the subjects used in the standardization of the speech lists. These lists were presented to the subjects at various intensity levels and articulation curves were plotted in each case. They obtained SRT of 13 dB (ref 0 SRT, 0 = 20 dBSPL) which is in close agreement with average pure tone which is 11.34 dB.Maximum score was obtained at 40 dBSL(Ref SET). In the clinical situation the speech discrimination test has to be administered at 40 dB above SRT. The present study resulted in standardized speech lists which are equal in difficulty and are valid

Conclusion:

1. The present lists yield similar results like any other valid tests of discrimination.

2. Normals obtained optimum discrimination at 40 dBSL with reference to SRT.

3. The obtained SRT agrees well with PTA.

4. All the four lists of each type found to be essentially equivalent and can be used interchangeabily.

Limitations of the study:

1. This study was limited to only graduate students.
2. Population tested was very limited in number.
3. Reliability test was not done.

Recommendations for further study:

1. Further standardization of the tests using a larger population.
2. The usefulness of the speech materials developed in the present study is to be established by testing a large clinical population.

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APPENDICES

APPENDIX-I

(Polysyllabic word lists)

List A

List B

List C

List D

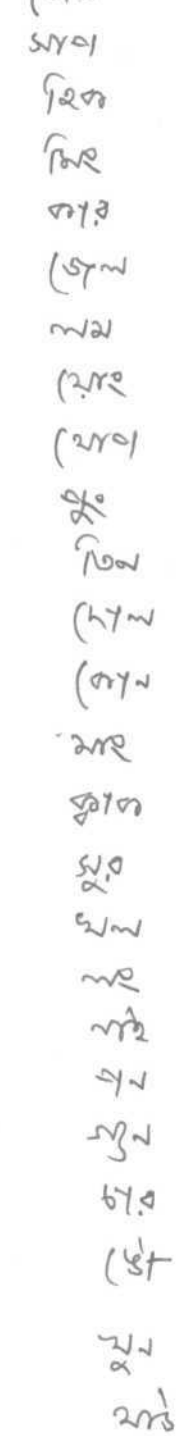
APPENDIX-II

(Monosyllabic word lists)

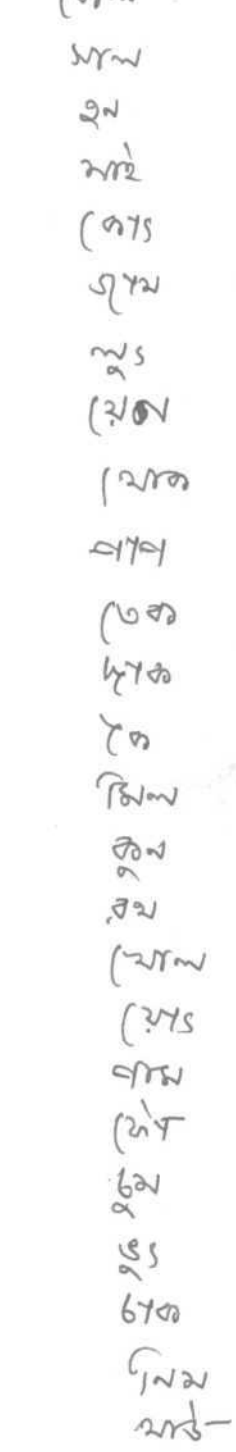
List A

List B

List C



List D



APPENDIX-HI

(English Word Lists)

SPONDEE LIST

1. Sunset
2. Play ground
3. Workshop
4. Birthday
5. Outside
6. Starlight
7. White wash
8. Blackboard
9. Housework
10. Although
11. Farewell
12. Daybreek
13. Mushroom
14. Northwest
15. Playmate
16. Doorstep
17. Earthquake
18. Lifeboat
19. Sundown
20. Stairway
21. Armchair
22. Handware
23. Outlaw
24. Cargo
25. Doormate

PB-LIST

1. Pen
2. Ten
3. What
4. Kite
5. Start
6. Does
7. Her
8. Give
9. Near
10. Poor
11. With
12. Young
13. Leave
14. Fate
15. Two
16. Bill
17. Oil
18. Then
19. Deaf
20. Arm
21. Hand
22. Though
23. Year
24. Move
25. My

APPENDIX-IV

Calibration;

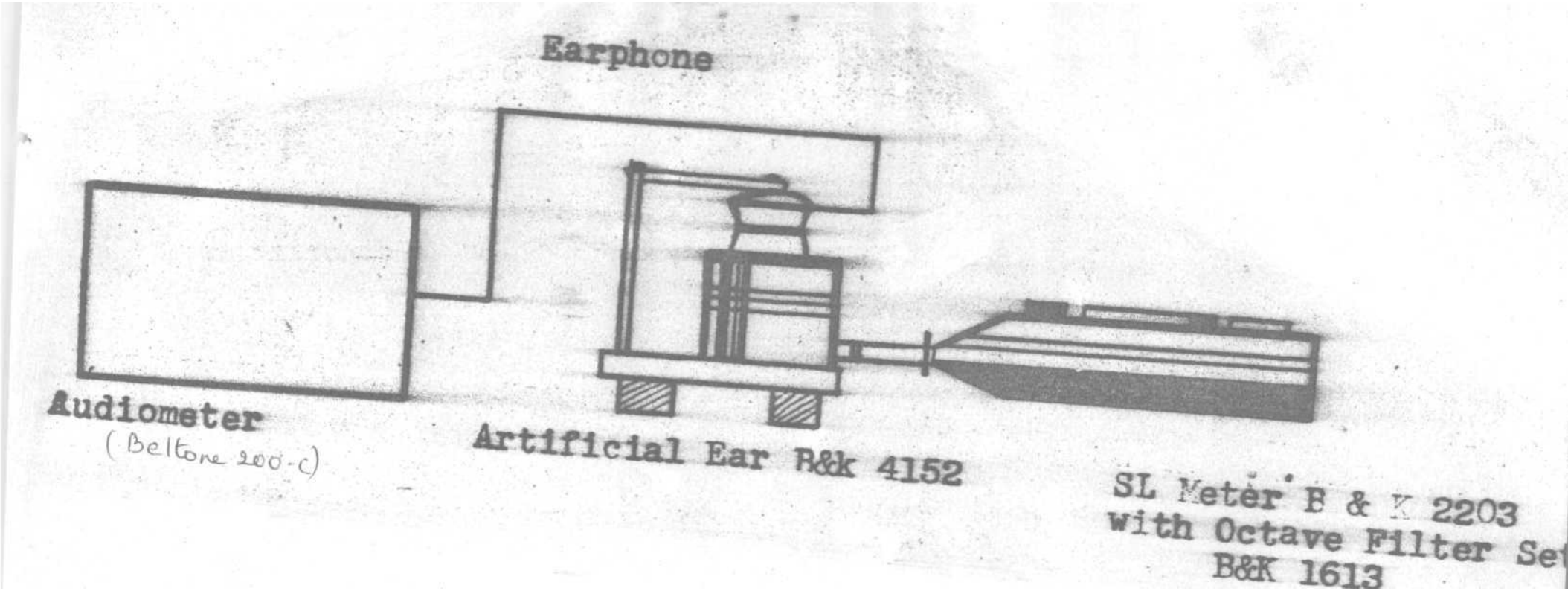
The audiometer used, Beltone 200-C was objectively calibrated before collecting the data and later daily check was done. It was calibrated for pure tone and speech. The procedure was as follows:

Puretone calibration:

Puretones were calibrated for both frequency and intensity.

Intensity calibration was carried out with the output of the audiometer set at 70 dBHL (ANSI, 1969), through the earphones (TDH-39 with MX-41/AR ear cushions) the acoustic output of audiometer was given to a condenser microphone (B&K 4144) which was fitted into an artificial ear (B&K 4152). The signal was then fed to a sound level meter (B&K 2203) with its associated filter set (B&K 1613) The output of the SLM was noted from 250 to 8000 Hz. A discripency of more than 2.5 dB between the observed SPL value and the expected value (ANSI Std. 1969) was corrected by means of internal calibration, by adjusting presets in the audiometer.

For frequency calibration, electrical output of the audiometer was given to a frequency timer/counter (Rodart 203). The difference between the dial reading on the audiometer and the digital display of a given frequency did not exceed permissible limits (±3%) given by ANSI 1969.



(BLOCK DIAGRAM SHOWING SETTINGS OF PURE TONE AND SPEECH CALIBRATION)

Speech Audiometer Calibration:

The set up of the instrument was same as for pure tones. The vowel /a/ was uttered into the microphone, such that VU meter peaked at '0' level. The output SPL was measured with the sound level meter. '0' dBHL was found to be equal to 20 dBSPL.

APPENDIX - V

The Noise Levels in the test room was as follows:-

Octave frequencies in Hz.		Level in dBSPL
125	-	38
250	-	28
500	-	23
1000	-	21
2000	-	21
4000	-	24
A-scale	-	35