SPEECH AUDIOMETRY IN THE PRESENCE OF IPSILATERAL MASKING NOISE

AN INDEPENDENT PROJECT WORK SUBMITTED IN PART
FULFILMENT FOR FIRST YEAR M.Sc,
(SPEECH AND HEARING) TO THE
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1985

TO MY DEAREST ANNA

CERTIFICATE

This is to certify that this Independent Project entitled "SPEECH AUDIOMETRY IN THE PRESENCE OF IPSILATERAL MASKING NOISE" has been prepared under my guidance and supervision.

Dr.M.N.Vyasamurthy
Guide

CERTIFICATE

This is to certify that the Independent Project entitled"SPEECH AUDIOMETRY IN THE PRESENCE OF IPSILATERAL MASKING NOISE" is the bonafide work submitted in part fulfilment for M.Sc., in Speech and Hearing of the student with Register No. 8410

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DECLARATION

This Independent Project entitled "SPEECH AUDIMETRY IN THE PRESENCE OF IPSILATERAL MASKING NOISE" is the result of my own study undertaken under the guidance of Dr.M.N.Vyasamurthy, 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.

Mysore
Date: May 1985 Register No. 8410.

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INTRODUCTION

INTRODUCTION

"One of the basic requirements of any organism is the need to communicate. Speech is an act of communication and is uniquely human"

(Irwin, 1963).

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 and insignificant part of the ordinary auditory experiences of most individuals. Its measurement is too limited to describe the individuals ability to understand the speech of his fellow communicators'.

(Hirsh, 1965).

A defective speech discrimination is one of the factors leading to a communication breakdown. Factors leading to a speech discrimination problem,can also be grossly classified into those that are intrinsic and those that are extrinsic to the individual.

Intrinsic factors that lead to disturbance in speech discrimination include pathologies of the auditory system which could be at the level of the cochlea, auditory nerve, or higher in the central auditory system. Further, psychological processes such as memory, fatigue, attention and intelligence can also bring about a deterioration in the speech discrimination scores.

Various extrinsic factors have been attributed.

a) The type of speech material, i.e. whether it is non-sense syllables, monosyllables, polysyllabic words or continuous discourse.

(Carhart, 1965; Speaks and Jerger, 1965)

b) Phonetic balance of the test lists

(Tillman & Carhart, 1966)

c) Use of a carrier phrase, as well as the content of the carrier phrase.

(Pederson, 1970)

d) Whether stimuli are presented through live voice or through recorded mode.

(Carhart,1965; Goetzinges, 1978)

e) The presence of a background noise.

(Carhart and Tillman 1970;
Keith and Tabis 1970;
Northern and Hattler, 1970).

In addition, Linguistic background of the listener and familiarity with the test words are known to affect speech discrimination scores.

(Sapon and Carrol, 1957; Black, 1952)

Need for the preseotstudy:

Speech audiometry has been found to be extremely useful in assessing the practical handicap of the hearing loss patients. Usually, speech audiometry (i.e. determining speech reception threshold and speech discrimination score) is carried out in a sound treated room. The results of the conventional speech audiometry may not be of much use in deciding the exact practical handicap of the hearing loss patients, as the performance of the patients in a sound treated room cannot be generalised to everyday listening conditions (everyday listening conditions are noisy). The patients may have difficulty in hearing speech in everyday listening conditions as they are noisy. The same patients may show good performance in speech audiometry (carried out in the absence of noise).

There are many patients who report that they have difficulty in hearing speech in noisy environments. But, these patients show normal hearing and normal speech discrimination (90-100%) in conventional speech audiometry. Thus, it appears that the conventional speech audiometry (carried out in the absence of noise) fails to assess the real practical handicap of the hearing loss patients.

In order to assess the real handicap of the hearing loss patients, it is necessary to determine SRT and discrimination score in the presence of Ipsilateral Noise, since the normal hearing subjects may also have difficulty in hearing speech in the presence of Ipsilateral Noise, it is necessary to have normative data (SRT and Discrimination Score) at various S/N ratios. These data would be useful to decide whether a particular subject's difficulty in hearing speech in noisy environments, is genuine or due to some psychological factors.

Brief plan of the study:

The present study has been designed to determine SRTs and Discrimination Scores at three S/N ratios viz. -10, 0, +10, in normal hearing adults.

The aim of the study is to establish normative data for SRT and maximum discrimination score in the presence of Ipsilateral Masking Noise (S/N ratios of -10, 0 and +10).

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Historical Aspects of the Development of Speech Audiometry

The development of Speech Audiometry gained its importance from the pioneering attempts made by Fletcher and his colleagues at the Bell Telephone Laboratory in 1920. These attempts replaced the whispering tests developed by Otologists for the screening purposes.

Then, Campbell and Crandall developed 'Articulation Tests' which consisted of a series of unintelligible words made up of

1) CVC
2) CV
3) VC

combinations and correct responses were scored as syllabic articulation score. But, because of lack of familiarity of the syllables, this test was not administered on the subjects.

In 1940, Hudgins at PAL developed a number of recorded speech tests. He evaluated many tests to measure speech intelligibility. He considered familiarity, phonetic dissimilarity, normal sampling of English sounds and homogeneity with respect to audibility.

In 1950, Haskins modified the Harward PB lists for children. Hirsh (1952) at Central Institute for Deaf developed the CIDW-22 monosyllabic word lists to assess discrimination ability. These lists have wide clinical applicability in speech audiometry.

Later, in 1959, Leniste and Peterson observed that the individual's linguistic background will significantly influence his judgement regarding the speech he hears. They developed lists that acted as phonetically balanced and they considered Harward PB-50 lists as imperfectly balanced.

In 1958, Fairbanks developed multiple choice type tests of closed message set. The first of such tests utilised rhyming monosyllables and it was called as "Fairbank's Rhyme Test". This tests the phonetic differentiation of the initial consonant or CV transition in monosyllabic words.

This test does not have face validity. But, still it's considered important because:

1. The test represented one of the earliest moves in the direction of the closed message set, as a means of assessing speech discrimination.

2. This test has served the pattern for a number of other tests, for example, the other test developed under this category was the multiple choice word intelligibility test by Black (1963).

House and others (1963, 65) developed a modification of Bairbank's Rhyme Test. The new instrument consisted of six equivalent lists of 50 words each. In developing these materials they took no strict account of either word familiarity or phonetic balance. The format of the test is such that the subject is given a response sheet containing all 300 items in the test arranged in 6 columns of 50 words each. For each stimulus word the subjects select a response from among six alternatives given in a row. Thus the modified Rhyme Test represents a truly closed response set. Also, this test assesses consonantal discrimination in both initial and final positions of the monosyllabic stimulus words.

(Rose, 1971)

House evaluated its performance with normal hearing observers at varying speech-to-noise ratios. The data suggested that the various forms of the test were statistically equivalent and that continued exposures to the test failed to produce improved performance, that is, practice effects were negligible.

In 1965, Kryter and Whitman compared performance of the Modified Rhyme Test with that on the 1000 item PAL PB-50 test using the same listening creus and various speech-to-noise ratios. They reported that in the performance region from 50-80% correct for the Modified Rhyme Test.

Scores on the PB Test were approximately 25% lower. They concluded that although Modified Rhyme Test is distinctly Lass complicated in administration and scoring, that is, it leads itself to automation, it is not so demanding a task as that presented by the PAL PB-50 test in so far as word intelligibility in noise is concerned.

In 1968, Kreul and others attempted to adapt the Modified Rhyme Test to make it a clinically useful tool. They felt that the format and test items were simple enough to be used with a wide range of clinical population and that when used in conjunction with a masking noise the test would be capable of rank ordering patients with respect to their everyday listening ability.

The investigators mixed the test items with noise before recording the composite signal on magnetic tape on the basis of performance of a group of normal hearing subjects.

Kruel and others selected three S/N ratios to be stored on their tape. The ratios were chosen so as to produce target discrimination scores of 96, 83 and 75% for normals. Three different talkers were involved in the recording process.

As a test of the accuracy of the target scores suggested by Kruel et al (1968) and Beyer et al (1969) administered the new test to 27 normal listeners. These investigators found no statistically significant differences among lists but did detect a significant talker effect. Also the average scores yielded by this listening crew fell some 2-3% below the target scores stated in the original report.

However, because the test has its simplified format, which minimizes problems of administration and scoring as well as problems associated with practice effects, the proposed new test is a potentially useful clinical tool.

In 1968, Jerger, Speaks and Tramwell described a new approach to speech audiometry using synthetic speech sentences. However, phonetically balanced monosyllabic lists are widely used as clinical tools.

Research findings in Speech Audiometry:

There are some studies relating to Test Materials and some studies pertaining to speech discrimination in Noise.

In 1957, Black reported that familiarity and intelligibility variables like:

1) Environmental noise
2) Signal level and
3) Distance in quiet

affect the discrimination scores.

In 1961, Owen did a study on the intelligibility of words varying in familiarity. It showed that lists characterised by greater familiarity even to a slight degree were significantly more intelligible.

Also, in 1963, Thomas Giolas and Aubrey Epstein attempted to compare the intelligibility of word tests and continuous discourse. It was concluded that monosyllabic word tests enable the individuals to understand speech and hence they should be used on the intelligibility testing.

In 1951, Miller, Heise and Lochlen's tested several factors as affecting the discrimination scores. The class of variables involved are:

1) Personnel
2) The test materials, that is, syllables, words, sentences or continuous discourse.
3) Communication equipment, that is, rooms, microphones, radios, amplifiers, earphones, etc.

In 1966, Brandy reported that the utterance of a given list of words even by the same talker resulted in significant differences in listener's performance.

Furthermore, mode of presentation, that is, live voice or recorded voice is to be considered.

In 1966, Brandy did a study and it showed that the recorded presentations are more reliable than live voice presentations, as greater variability is involved in the talker's presentation.

However, in 1961, Portman and Portman had favoured live-voice technique as it permitted a flexibility in the clinical procedure.

In 1969, Nixon did a study, which was regarding the use of carrier phrase. He concluded that the carries phrase does not affect speech discrimination scores.

The carrier phrase is desirable for 2 reasons.

1. The listener is prepared for the presentation of the test item and variability in the articulation scores due to inattention or distraction is reduced.
2. This permits the announces to modulate his voice so as to keep the level of his voice even from word to word.

There are various studies pertaining to speech discrimination in noise also.

Cooper, Berry and Cutts (1964) reported that there is reduction in a speech discrimination task with the introduction of noise.

In 1955 Palva reported the less scores for sensori-neural hearing loss cases at SN ratio of +10.

Also, in 1962 Olsen conducted tests on hearing impaired persons. He concluded that hearing impaired persons experience more difficulty in understanding speech under noisy situations.

In 1968 Kruel had attempted to use the Modified Rhyme Test with masking noise on normal at different S/N ratios. He found significant differences in discrimination scores.

The importance of the use of speech in noise in Diagnostic Audiometry was stressed by Keith and Talis in 1970.

One of the purposes of collecting speech discrimination scores is to assist in the diagnostic differentiation among patients with hearing impairments.

Poorer the SN functions, the worse the discrimination score. But the statement is not necessarily true.

However, in fact, many patients with cochlear hearing impairments show no abnormal discrimination score. Thus, the discrimination score cannot be used in diagnosis of at least some pathologies. Nevertheless the CID auditory test W-22 (Hirsh, 1952) continues in wide use in spite of the fact that it does not always provide effective diagnostic differentiation.

In 1956, Silverman and Hirsh pointed out that W-22 recordings do not distinguish between conductive and non-conductive hearing loss as do the Rush-Hughes recordings.

Also, in 1965, Carhart indicated that 60% of 170 hard-of-hearing veterans tested with W-22 recordings obtained discrimination score of 90% or better, in his study.

Thus, the discrimination score in this group did not contribute to a diagnosis of presence, type, or degree of hearing loss.

But Keith and Tails attempted to confirm Carhart's data on patients with known hearing loss and they examined the records of 170 veterans who were not yet 60 years old and who had primarily SN hearing loss. The losses were either High Frequency of 40 dB or greater at 4 KHz or flat losses of greater than 30 dB.

Discrimination scores for the better ear of our 170 veterans are slightly higher than Carhart's data and of the poorer ear slightly lower than Carhart's. The data appear to confirm that W-22 discrimination score obtained in quiet is of little diagnostic value for large number of patients.

In 1965, Ross et al, examined the clinical utility in discrimination score in noise but found no significant differences between hearing impaired and normal hearing groups. Although, he made no specific recommendations, they suggested that different kinds and SL of noise would result in desired differences in discrimination scores.

So use of speech in noise aids in diagnostic audiometry, since SN loss cases obtain very poor scores under noisy environments.

Effects of Noise on Speech Discrimination Scores was studied by Young and Harbert (1970}.

In 1947, Davis, Steven and Nichols conducted a study. It was known that for speech presented in quiet little change in discrimination was obtained in normal subjects for overall speech levels to 130 dB SPL.

Also thresholds of intelligibility and perceptibility for speech, expressed in terms of the speech/noise ratio were independent of overall level from 30-110 dB.

In 1958, Pollack and Pickett reported that with a speech/noise ratio of +15 dB or greater, discrimination score for PB words in normal ears was 80% or more at testing levels ranging from 80-130 dB. However, discrimination score became progressively worse as the testing level increased if S/N ratio was lower than +15 dB.

Effects of Ipsilateral and Contralateral presentation of masking noise on speech discrimination scores were studied in 7 normal hearing subjects, 65 subjects with unilateral total hearing loss and normal hearing in the opposite ear, and 15 subjects with bilateral symmetrical hearing loss.

Normal yielded discrimination scores greater than 70% when S/N ratio was +5 dB and higher, and less than 50% when SN ratio was -5 dB and lower. Discrimination score was essentially 0% at S/N ratio of -20 dB or less, both when speech and noise were mixed and presented monaurally and when speech was presented to one ear and noise to the other.

In subjects with unilateral total hearing loss on s/N ratio about 10 dB higher was required to obtain discrimination score equivalent to normals, whether both speech and noise were presented to the deafened ear or speech was delivered to the deafened ear (that is to the normal ear by ac) and noise in the opposite ear; but when speech was presented to the normal ear and noise to the deafened ear and S/N about 5 dB lower was required for equivalence.

In subjects with bilateral SN loss, the effect of SN ratio were similar to those in normals. An asymptote in discrimination score was obtained by usually at a S/N ratio of +15 dB.

Monaural presentation of both signals and noise produced discrimination score equivalent to those reported by Shuster (1961) who used binaural presentation of speech and noise from the same loudspeaker in a free field.

METHODOLOGY

METHODOLOGY

The Methodology of the present study is described under the following headings:

1) Subjects
2) Test Materials
3) Recording procedure
4) Instrumentation
5) Test Environment and
6) Test Procedure

Subjects:

Totally fifteen normal hearing subjects (20 dBHL ANSI, 1969) were selected.(8 males and 7 females) with age ranging from 16 years to 24 years (Mean age = 20 years).

The subjects were selected on the basis of the following criteria:

1) The subjects should know English and Kannada languages.
2) The subjects should have normal hearing (20 dBHL ANSI, 1969).
3) The subjects should have no history of ENT problems.

Subjects were divided into 3 groups, each group consisted of 5 subjects. Each group was tested at different S/N ratios.

Test Materials:

To determine the intensity level at which the discrimination test had to be administered, the speech reception threshold had to be first obtained. Spondees word list in English was used to obtain the SRT scores.

The PB words list in English and Monosyllables List in Kannada Language were used to determine the speech discrimination scores. The test words were recorded and the recorded -materials was used in the test.

Recording Procedure:

Recording was done in the sound-treated room using the Philips Cassette Deck.

The speaker was a Young Indian Male whose English was considered to represent Indian English. He was fluent in English as well as Kannada.

The speaker had practised the speech materials well before the final recording was done. He was given adequate training to monitor his voice such that the VU meter needle on the tape recorder, peaked to a constant point while he uttered the test words.

The carrier phrase "say the word______" was said prior to each spondee and mono-syllable. Here the purpose of using the carrier phrase was two-fold.

1) To alert the attention of the patient to listen for the test item, and

2) To monitor the voice while recording. It was not meant to give any meaning to the patient.

The intensity level of the carrier phrase was maintained such that the VU meter needle peaked constantly at a particular point and the test stimulus was allowed to follow in a natural manner.

Between each spondee as well as mono-syllable word, a silent interval of eight seconds was maintained.

The intelligibility of the recorded materials was tested on a few normals. The test materials were also judged for other distortions.

Instrumentation:

1) Beltone 200-C Audiometer

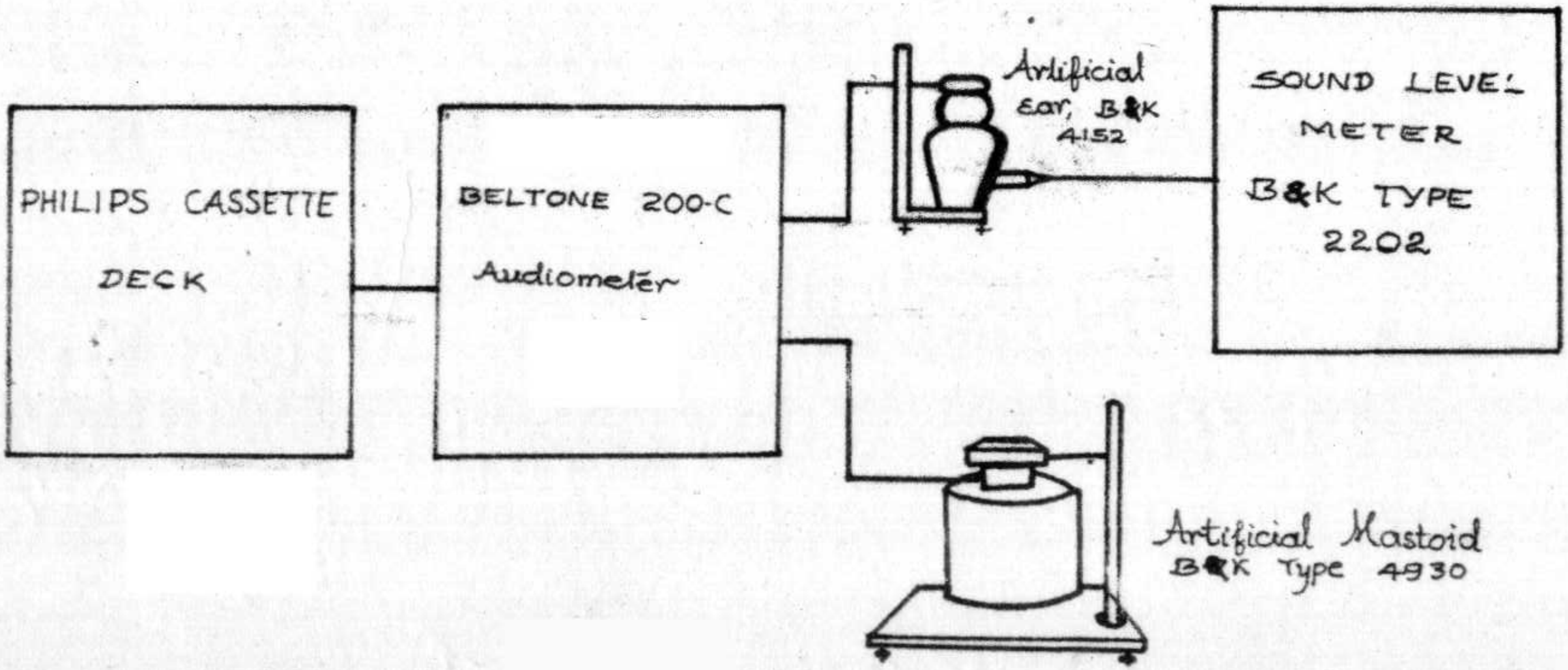
2) Philips Cassette Deck

Tape recording was done using the Philips Cassette Deck itself. The recorded tape was played on the Philips Cassette Deck, the output of which was fed to the tape input of the clinical audiometer (Beltone-200-C). The output of the audiometer was given to ear phones TDH-39 housed in ear-cushions MX-41AR.

Calibration:

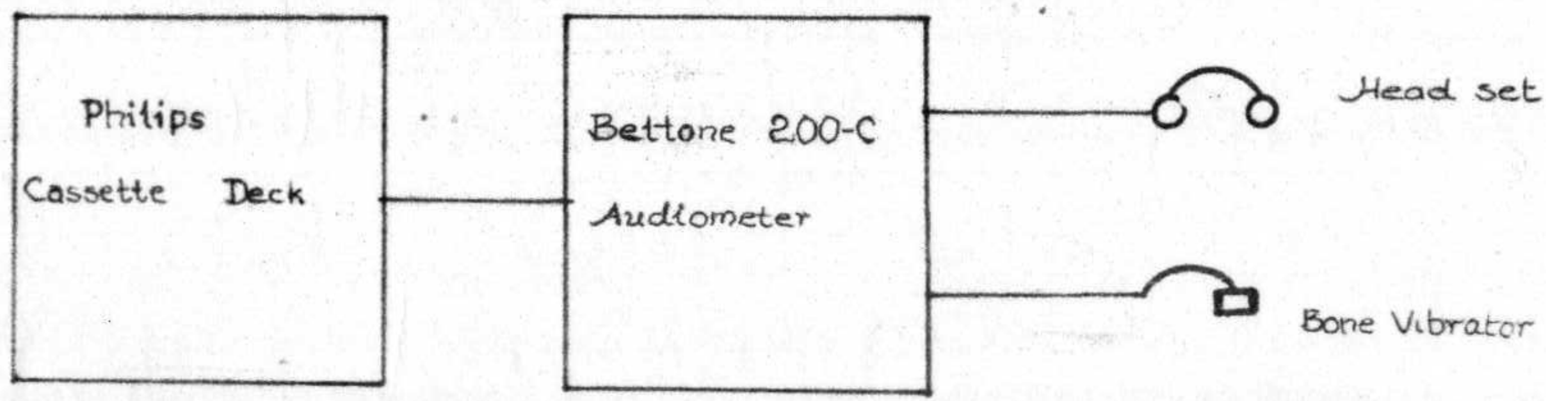
Beltone 200-C Audiometer was calibrated for Pure-tones and speech noise. Calibration for Air-conduction, Bone-conduction, Speech, Intensity Dial, Noise levels was done using Artificial

BLOCK DIAGRAM I



ARRANGEMENTS OF THE INSTRUMENTS FOR CALIBRATION

BLOCK DIAGRAM II



Set up of the Instruments used in the study

Ear, Artificial Mastoid and Sound Level Meter with Octave Filter Set (all B&K type) at the Electronics Lab, All India Institute of Speech and Hearing.

Subjective calibration was done everyday. Instrumental calibration was repeated once a month till the study was very stable.

Block diagrams I and II indicate the arrangement of the instruments for calibration and set up of the equipment for testing purposes respectively.

For intensity calibration purposes, the test earphone TDH-39 of the audiometer was coupled to an artificial ear (B&K 4152) and SLM (B&K 2202) with its associated Octave Band filterset. The attenuator was set at 60 dB HL. The output of the SLM was checked from 250 to 8000 Hz. All the readings were within the normal limits.

Speech Noise Calibration:

With the same set up the output of Speech Noise at 80 dB and 60 dB HL was noted. The output at 60 dB HL was equal to 80 dB SPL and the output at 80 dB HL was 100 dB SPL.

Zero dB HL during speech audiometry was found to be 20 dB SPL.

Test Environment:

Test was administered in a sound treated room. A two-room situation was used. The noise level in the test room was measured using a Sound Level Meter (B&K 2209) with an Octave Filter Set (B&K 1613) and a Condenser Microphone (B&K 4165). The noise levels were within the permissible limits.

Test Procedure:

The pure-tone, air-conduction and bone-conduction thresholds were obtained for the frequencies 250 Hz to 8 KHz and 250 Hz to 4 KHz respectively, for all the 15 subjects. The Modified Hughson-Westlake procedure was utilized (Carhart and Jerger, 1959).

Only one ear (i.e.) Right ear was tested for all the subjects.

Speech Reception Threshold was found in the absence of Ipsilateral Noise. The subjects were first familiarised with the test, by reading out the list in an alphabetical order, in a face to face situation.

The following instruction was given:

"You will hear the words over the Earphones, but in a different order. Before you hear the word you will hear the phrase 'say the word______' repeat the word that follows the phrase. You may guess the words if you are not sure of them. Do you have any questions?".

The SRT was determined by first presenting the spondees at 30 dB HL. If the spondees were correctly repeated, the intensity was reduced in 10 dB steps. The lowest level at which the subject repeated 2 spondees correctly (out of 3 spondees) was taken as the SRT.

The Speech Reception Threshold in the absence of Ipsilateral Noise was noted down.

The Speech Reception Threshold was determined in the presence of speech noise in the same ear. Each group of subjects was tested at a different S/N Ratios, which is as follows:

Ist Group was tested at S/N ratio of -10

IInd Group was tested at S/N ratio of 0 and

IIIrd Group was tested at S/N ratio of +10

The Speech Reception Threshold in the presence of Ipsilateral Noise was noted down.

The shift in the Speech Reception Threshold due to Ipsilateral Noise was calculated - it indicates the difference between the SRTs obtained in the presence and in the absence of Ipsilateral Noise.

Then Speech Discrimination Score was obtained at 40 dB above SRT. At first, Discrimination Score was obtained in the absence of Ipsilateral Noise that is in the quiet condition.

PB words in English as well as monosyllables in Kannada were used as Test words for determining Discrimination Scores. Twenty test words were presented and the number of correct responses was noted down. Discrimination Score in percentage was calculated.

Later, discrimination scores were obtained in the presence of Ipsilateral Noise. All the 3 groups of subjects were tested at different S/N ratios.

Ist Group was tested at S/N ratio of -10
IInd Group was tested at S/N ratio Of 0 and
IIIrd Group was tested at S/N ratio of +10.

The discrimination scores in the presence of Ipsilateral Noise, in terms of percentage was noted down.

The effect of Ipsilateral Noise on discrimination was calculated. The difference between the discrimination scores obtained in the presence and in the absence of Ipsilateral Noise was calculated.

RESULTS AND DISCUSSIONS

RESULTS AND DISCUSSIONS

Table-1 shows Speech Reception Thresholds and Discrimination Scores (with Means and Standard Deviations) of the three groups (I, II and III) in quiet and in presence of Ipsilateral Noise.

Column 4 in the Table-1 shows the shift in the SRT due to Ipsilateral Noise. It indicates the difference between the SRTs in quiet condition and in the presence of Ipsilateral Noise. The Mean shifts in SRT due to Ipsilateral Noise were calculated for all the three groups (I, II and III).

The shift in SRT due to Ipsilateral Noise waa observed more in the Ist Group of subjects who were tested at Signal to Noise ratio of -10. The shift in SRT was less in the IIIrd Group of subjects who were tested at Signal to Noise ratio of +10.

The present study shows that the Ipsilateral Noise affects SRT at all the S/N ratios tested viz. -10, 0 and +10.

Column 7 in the Table-1 shows the 'Discrimination Loss' due to Ipsilateral Noise. Discrimination Loss is the difference between the Discrimination Scores in Quiet and in presence of Ipsilateral Noise.

The Mean Discrimination Loss (Discrimination Score in quiet - Discrimination Score in the presence of Ipsilateral Noise) was calculated for all the three groups (I, II and III). Scores were obtained for both English PB words and Kannada Monosyllables Discrimination Loss (Discrimination Score in quiet - Discrimination Score in the presence of Ipsilateral Noise) was observed more in the Ist Group of subjects who were tested at Signal to Noise ratio Of -10.

The Mean Discrimination Loss was 50% (for English PB words) and 38% (for Kannada Monosyllables).

Discrimination Loss (Discrimination Score in quiet - Discrimination Score in the presence of Ipsilateral Noise) was negligible in the IIIrd Group of subjects who were tested at signal to Noise ratio of +10.

The Mean Discrimination Loss was 3% (for English PB words) and 0% (for Kannada Monosyllables). Thus, the Ipsilateral Noise has effect on Discrimination Scores at S/N ratios of -10, 0 and +10.

The data of the presence study can be used to detect subjects with normal thresholds who report Speech Discrimination problem in noisy environments. Testing such subjects at S/N ratio of 0 or +10 would be desirable. On testing, if such subjects show greater discrimination loss (Discrimination Score in quiet - Discrimination Score in the presence of Ipsilateral Noise) i.e. more than the normal value (15% for English PB words and 6% for Kannada Monosyllables), they can be considered to have speech discrimination problem in noisy environments. Present study showed that the normals discriminate better at S/N ratio of +10.

Table-1: Shows Speech Reception Thresholds and Discrimination Scores (with Means and Standard Deviations) of the three groups (I, II and III) in quiet and in presence of Ipsilateral Noise.

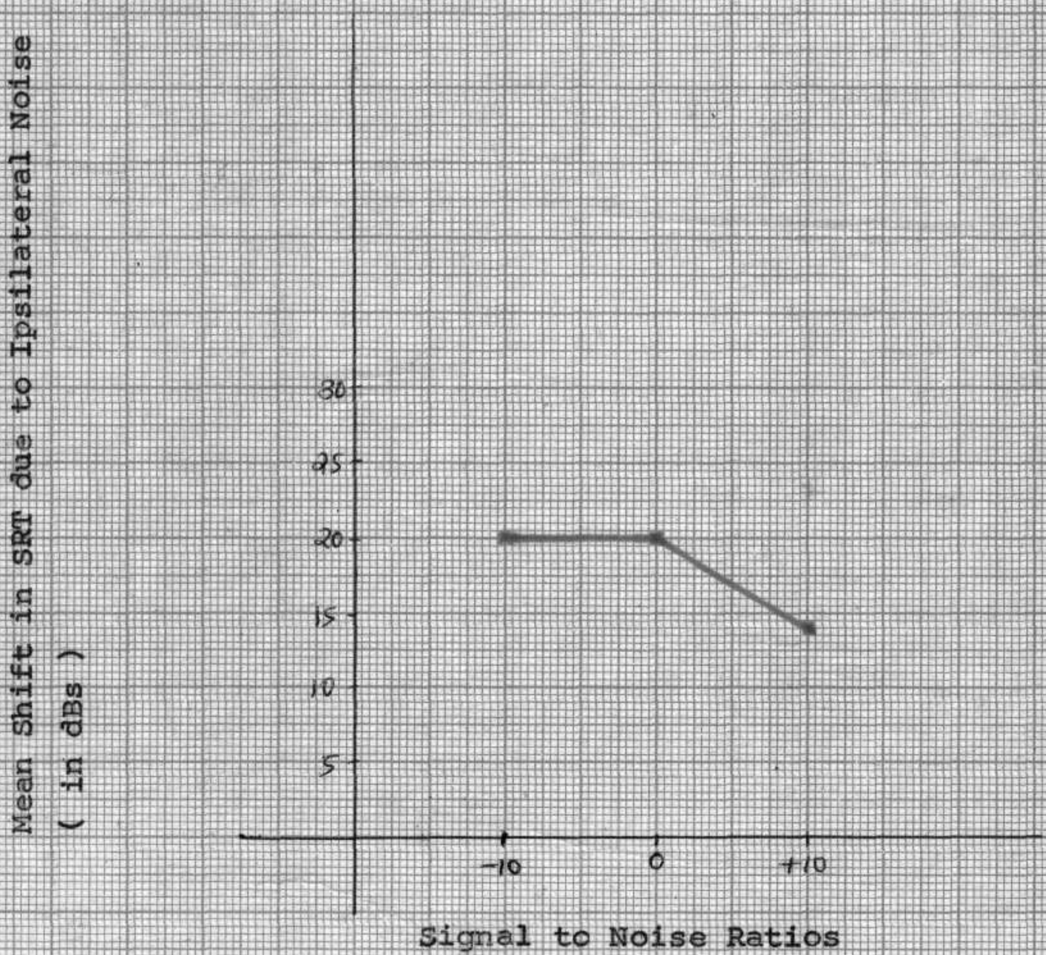
Serial No. of subjects 1.	SRT in quiet condition 2.			SRT with Ipsilateral Noise 3.			Shift in SRT due to Ipsilateral noise (Column-3 - Column-2) 4.		
	Group-I	Group-II	Group-III	Group-I S/N= -10	Group-II S/N = 0	Group-III S/N = +10	Group-I	Group-II	Group-III
1	10 dB	5 dB	15 dB	35 dB	20 dB	30 dB	25 dB	15 dB	15 dB
2	10 dB	15 dB	10 dB	35 dB	35 dB	20 dB	25 dB	20 dB	10 dB
3	5 dB	10 dB	5 dB	20 dB	25 dB	15 dB	15 dB	15 dB	10 dB
4	5 dB	15 dB	10 dB	20 dB	40 dB	25 dB	15 dB	25 dB	15 dB
5	5 dB	5 dB	10 dB	25 dB	30 dB	30 dB	20 dB	25 dB	20 dB
Mean	7 dB	10 dB	10 dB	27 dB	30 dB	24 dB	20 dB	20 dB	14 dB
Standard Deviation	3.87	6.71	5.92	10.49	12.25	8.37	6.71	6.71	7.07
Range									

Contd..Table-1

In continuation of Table-1

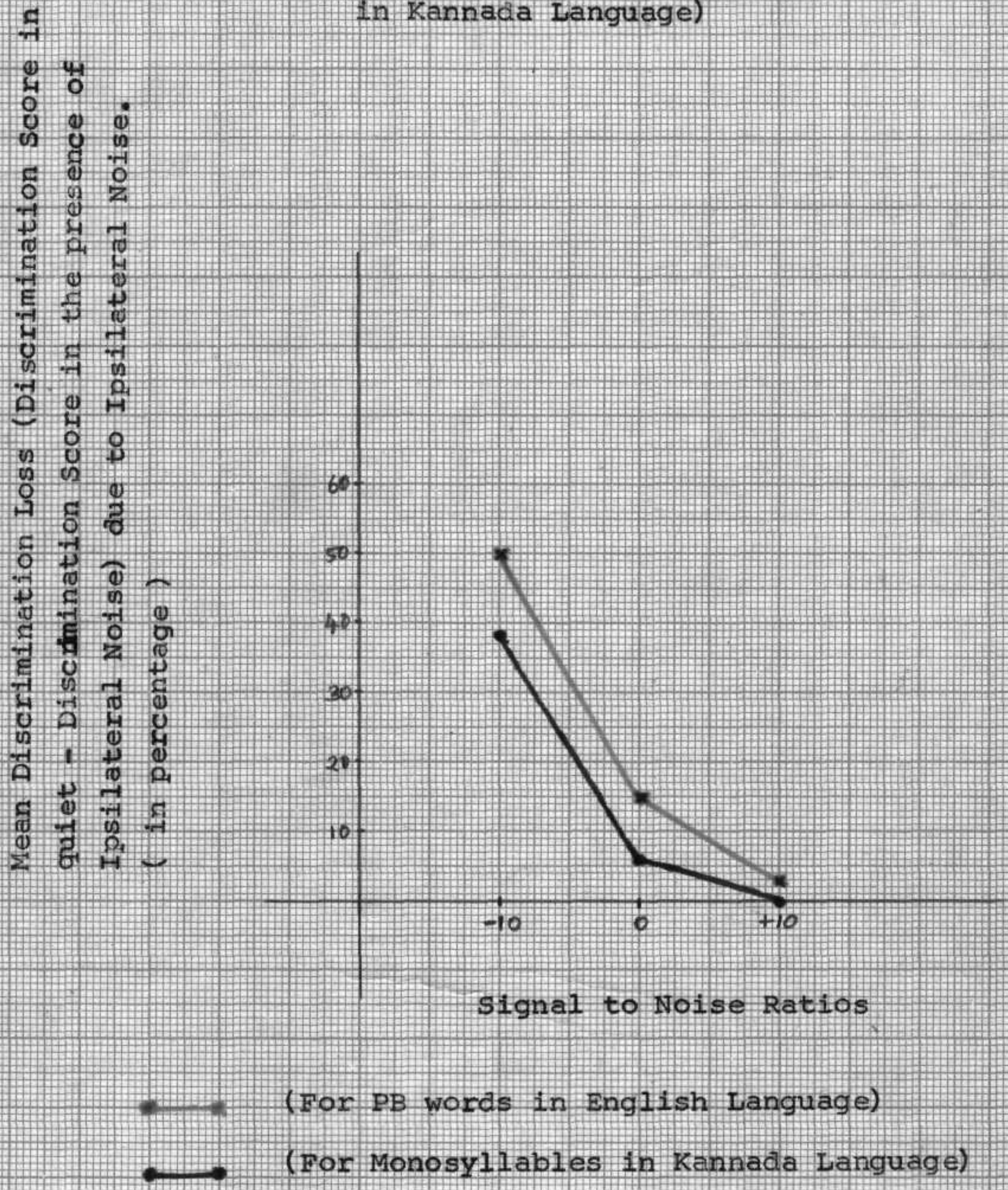
Serial No. of subjects	Discrimination Score in quiet condition			Discrimination Score in the presence of Ipsila– teral Noise. 6.						Discrimination Loss (Dis- crimination Score in quiet - discrimination score in the presence of Ipsilateral Noise) 7.					
	Group-I	Group-II	Group-III	Group-I S/R=-10		Group-II S/N = 0		Group-III S/N = +10		Group-I S/N=-10		Group-II S/N= 0		Group-III S/N = +10	
				English	Kannada	English	Kannada	English	Kannada	English	Kannada	English	Kannada	English	Kannada
1	90%	95%	95%	40%	45%	80%	90%	90%	95%	50%	45%	15%	5%	5%	0%
2	95%	90%	95%	45%	60%	70%	85%	90%	95%	50%	35%	20%	5%	5%	0%
3	95%	90%	95%	55%	65%	80%	90%	95%	95%	40%	30%	10%	0%	0%	0%
4	95%	90%	95%	45%	60%	80%	85%	95%	95%	50%	35%	10%	5%	0%	0%
5	95%	95%	95%	35%	50%	75%	80%	90%	95%	60%	45%	20%	15%	5%	0%
Mean	94%	92%	95%	44%	56%	77%	86%	92%	95%	50%	38%	15%	6%	3%	0%
Standard Diviation	2.24	3.87	0.0	12.85	10.49	5.0	5.48	3.87	0.0	11.83	9.22	6.71	10.25	3.16	0
Range	90-95	90-95	-	35.55	45-65	70-80	80-90	90-95	-	40-60	30-45	10-20	0-15	0-5	0

Shows: Mean Shift in SRT at three S/N Ratios i.e. -10, 0, +10 (for spondees in English)



(For Spondees in English Language)

Shows: Mean Discrimination Loss (Discrimination Scores in quiet - Discrimination Score in the presence of Ipsilateral Noise) at three S/N Ratios i.e. -10, 0, +10 (For PB words in English and Monosyllables in Kannada Language)



SUMMARY AND CONCLUSIONS

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The aim of the study was to establish normative data for Speech Reception Threshold and Maximum Discrimination Scores in the presence of Ipsilateral Noise (S/N ratios of -10, 0 and +10).

Totally fifteen normal hearing subjects (20dBHL ANSI, 1969} were selected (8 males and 7 females) with age ranging from 16 years to 24 years (Mean age = 20 years).

Subjects were divided into three groups, and they were tested at different S/N ratios as given below:

Ist Group of subjects at S/N ratio of -10.

IInd Group of subjects at S/N ratio of 0.

IIIrd Group of subjects at S/N ratio of +10.

Spondees word list in English, PB words list in English and Monosyllable list in Kannada language were used to determine the Speech Reception Threshold and Discrimination Scores. Recorded spondees and monosyllables were used to test the subjects.

Beltone 200-C Audiometer was calibrated and used along with Philips Cassette Deck for testing. The testing was done in a sound treated room.

Data were obtained and analysed using appropriate statistical procedures. Means and Standard Deviations of the scores were obtained. The Mean shifts in SRT due to Ipsilateral Noise were calculated for all the three groups of subjects (I, II and III). Also, the Mean Discrimination loss (Discrimination Score in quiet - Discrimination score in the presence of Ipsilateral Noise), was calculated for all the three groups of subjects (I, II and III). The following results were obtained.

1. The shift in SRT due to Ipsilateral Noise was observed more in the Ist Group of subjects who were tested at S/N ratio of -10. The shift in SRT was less in the IIIrd Group of subjects who were tested at Signal to Noise ratio of +10.

   The Mean Shift in SRT due to Ipsilateral Noise was 20 dB in Ist Group of subjects, and the Mean Shift was 14 dB in IIIrd Group of subjects.

2. Discrimination Loss (Discrimination Score in quiet - Discrimination Score in the presence of Ipsilateral Noise) was observed more in Ist Group of subjects who were tested at S/N ratio of -10, and it was negligible in IIIrd Group of subjects who were tested at S/N ratio of +10.

The Mean Discrimination Loss was 50% (for English PB words) and 38% (for Kannada Monosyllables) in Ist Group of subjects, and it was 3% (for English PB words) and 0% (for Kannada Monosyllables).

From the above results, the following conclusions can be drawn:

1. Ipsilateral Noise has an effect on Speech Reception Thresholds and Discrimination Scores.

2. The Maximum Discrimination Scores can be obtained at S/N ratio of +10. That is, the present study showed that the speech discrimination is not affected in normal subjects if the testing is done at a S/N ratio of +10.

3. Data of the present study can be used to detect subjects with normal thresholds who report speech discrimination problem in noisy environments. On testing, if such subjects show greater. Discrimination Loss (Discrimination Score in quiet - Discrimination Score in the presence of Ipsilateral Noise) i.e. more than the normal value (15% for English PB words and 6% for Kannada Monosyllables), they can be considered to have Speech Discrimination problem in noisy environments.

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