MY DEAREST APPA AMMA

ESTABLISHMENT OF NORMS FOR D.S. TEST

Register No. 8404

An independent project submitted as part fulfilment for First Year M.Sc. (Speech and Hearinq) to the University of Mysore,

MAY 1984

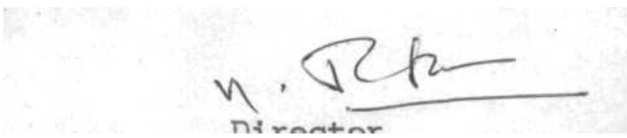
All India Institute of Speech and Hearing,
MYSORE-570 006.

CERTIFICATE

This is to certify that the Independent Project Entitled:

"ESTABLISHMENT OF NORMS FOR D.S. TEST"

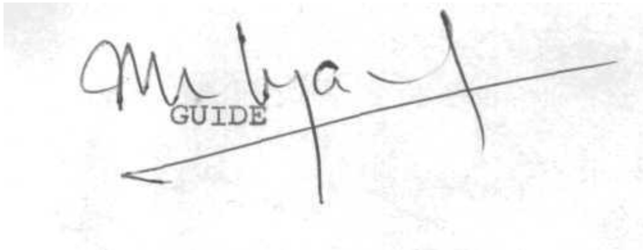
is the bonafide work in part fulfilment for the Degree of Master of Science in Speech and Hearing with Register No. 8404



Director
All India Institute of Speech and Hearing, Mysore-6

CERTIFICATE

This is to certify that this Independent Project entitled: **ESTABLISHMENT OF NORMS FOR D.S. TEST** has been prepared under my supervision and guidance.



DECLARATION

This Independent Project entitled: **"Establishment of Norms for D.s. test"** is the result of my own study undertaken under the guidance of Dr. M.N.Vyasamurthy, Lecturer in 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

April 1984 REGISTER No. 8404

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INTRODUCTION

CHAPTER-I

INTRODUCTION

Functional hearing loss refers to any hearing loss which has no organic basis, either in whole or in part. There are many reasons why a functional hearing loss will occur, but two general explanations are frequently advanced. The first is that the person is either consciously or subconsciously attempting to shut off all or a portion of his hearing environment because what he hears imposes a serious measure of threat to his psychological stability, The second deals with the fact that the patient gains something directly, such as a child who gains attention or an accident victim who gains financial reward.

Throughout the literature there is a wide variety of techniques and methods for the differential diagnosis and measurements of functional hearing loss.

Patients with functional hearing loss employ a figurative yard stick and fail to respond to any sound which fainter than his self-imposed threshold. The key to the problem of discovering psychogenic loss seems to lie in destroying, or at least disturbing the patients unconscious yardstock, so that he has no reliable means of determining the loudness of the stimulus. Following these principle a test was developed by Doerfler and Stewart (1946).

The D.S.test in used to detect binaural pseudohypacusis. The test compares responses to speech versus noise. Most normals are not affected when the noise level is 10-15 dB greater than the speech level. But the non-organic patient tends to stop responding even when the noise is less intense than speech (Doerfler and Stewart, 1946; quoted by Newby 1962; p.171; Hopkinson, 1973 and 1978).

Pseudohypacusis or functional hearing loss is not common in our country as industrial hearing conservation programmes are yet to be initiated. However, the introduction of pension scheme for the hearing handicapped by the Government of Karnataka, has increased the number of pseudohypacusis cases. In order to get pension from the Government some people have attempted to feign hearing loss. D.S. test is one of the audiological tests used to detect pseudohypacusis. To administer this test,it is essential to have normative data (for D.S. test). The present study deals with the establishment of norms for D.S. test.

REVIEW OF LITERATURE

CHAPTER - II

REVIEW OF LITERATURE

Definitions and Terminology:

Many terms have been used to refer to functional hearing-loss, psychogenic, non-organic hearing loss, psychic deafness, auditory malingering, pseudohypacusis____etc. Many authors have pointed out the ambiguities created by these large number of terms (Ventry and Chaiklin, 1962; Williamson 1974; Martin, 1978). Martin supported the use of term "pseudohypacusis" given by Carhart (1971), and "non-organic hearing loss" because of their specific reference to hearing loss.

Ventry and Chaiklin (1962) proposed the term "Functional hearing loss" - is most appropriate term to denote audiometric discripancies that do not have an apparent organic etiology. When correctly used as a diagnosis, it means that the patients hearing problem has been investigated as thoroughly as possible with the best available instruments and methods and that no organic factor was found to account for his symptom.

Malingering is not a synonym of "functional". According to Jerger (1963) "malingering in a specific term referring to concious exaggeration of fabrication of symptoms for primary or secondary gain. "Malingering" in therefore, better used as a symptom rather than diagnosis.

The literature reveals that little recognition was given to the problem of function hearing loss before world war-II. The limited attention may have been related to failure to recognize the problem, the paucity of standerdized tests, inadequate equipment, or the possibility of a lower incidence of functional loss than exists today. In 1956, the incidence of functional hearing in the Veterans Administration Hospital population was estimated as 11% to 45% (Jerger, 1963).

Doerfler (1951) reported that the incidence of functional hearing loss in children varied from 0 to 7%. Functional hearing loss in children appears more often in females than in males (Jerger, 1963).

Identification:

Frequently the source of referral will suggest the possibility of pseudohypacusis—(Martin, 1978) and also the information obtained during case history.

One method used in diagnosis which has been highly criticized in the subjective evaluation of behavioral cues. It in obvious that the subjective evaluation of anything, much less of behavior has its limitations. First, the diagnostic significance of any facet of patient behavior reported in various studies has not been validated. Secondly some of the behavior cues clinicians associate with functional loss are also associated with organic loss. Thirdly, many reported behavioral variations can be traced to differences between the clinician and the client. Behavior observation can be useful as pointing in the direction of a diagnosis, but not as the sole diagnostic clue (Williamson).

Pure tone audiometry serves as a point of departure for further audiological study. One of the first indications of possible presence of functional loss is an inconsistent threshold response and general difficulty in obtaining a reliable response to pure tone stimuli. Harris (1958) suggested first plotting an audiogram utilizing only ascending threshold explanation and then recording a second audiogram using the descending approach. If there is a marked discrepancy between the two audiograms, one has reasons to suspect a functional loss. Other subtle indications which should alert the tester are (l) a sensori-neural impairment with a saucer-shaped audiogram which may follow an equal loudness contour for either bone conduction or air conduction stimuli. When masking has not been used with a marked difference in professional thresholds noted between the two ears, and (2) professed thresholds greater than logically predictable through observation of the clients response to oral communication.

A functional hearing loss can be suspected by comparing the pure tone average to the SRT. It seems that at the same hearing level, the loudness of a speech stimulus is substantially greater than that of a pure tone. Consequently, the person with a functional loss, who apparently bases his response on a loudness criterion, will repeat spondee words at levels substantially lower (better) than he voluntarily responded to tonal stimuli (Mafkin and 01sen,197l). A patient with functional hearing loss may repeat 1/2 a spondee during SRT measurements, there is no valid logic, why he should not repeat other half.

Special tests:

Stenger Test:

This test is used to identify unilateral functional hearing loss. The Stenger principle states that, when two tones of same frequency are introduced simultaneously into both ears, only the louder tone will be perceived (Martin, 1978).

In this the stimulus is presented binaurally, slightly above threshold (SL of 5 or 10 dB) in the better ear and at varying levels below the threshold obtained for the poorer ear. Two of the most common responses observed when the Stenger test is positive are (1) that the patient may cease responding to tones in both ears or (2) that he may continue to respond even though the stimulus in the better ear has been withdrawn. The test is considered positive if either form of behavior occurs significantly below (15 dB or more) the admitted threshold for the poorer ear (Ventry and Chaiklin).

This test can be done using pure tone or speech as stimulus.

Delayed Auditory Feedback Test (DAF):

Originally, the concept of DAF was laid by Lee and Blake (1950, 1951). They observed changes in vocal rate and intensity as a result of the subjects hearing his own voice delayed in time.

The feedback is provided at a level lower than the admitted threshold and changes in test tasks are noted down. A change in a given task is expected when a person hears the delayed feedback. Generally speech and tapping tasks are employed. The test can be used with both unilateral and bilateral cases (Newby, 1972; Hopkinson, 1973; Martin, 1978).

The delay is produced by modifying a tape recorder, to produce different amounts of delay (Newby, 1972). A delay of 0.1 to 0.2 seconds has been found to have maximum effects (Ruhm and Cooper, 19 ; Newby 1972).

Story Test:

Story tests are used mainly to verify a monaural hearing loss. A two channel speech audiometer is necessary with the facility for switching from one ear to the other and to a binauaral position (Hopkinson).

Parts of the story are delivered to the better ear, parts to the poorer ear, and parts to both ears, if the level has been chosen effectively at the outset, and if the patient repeats parts of the story delivered to the poorer ear, then the hearing can be said to be at least at the level. The story should be designed so that it is wholly integrated and makes sense, in the event that the patient has an organic monoaural loss and hears only those parts delivered to the better ear or both ears.

Lombard Test:

The Lombard test has been used to identify either unilateral or bilateral functional hearing loss. The basis of the test in the Lombard reflex which is relatively automatic increase in a speaker's vocal intensity in the presence of intense noise (Ventry and Chaiklin).

The patient is asked to read some material while a masking noise is fed in to the earphones, he is wearing. As the noise level is increased or decreased, the changes in the voice intensity are noted. The test is positive, if increase in voice intensity is noticed, when the masking noise is increased. If the noise level which brings changes in intensity of voice, is less than the admitted hearing levels, functional component can be suspected. The test is negative, if no changes in voice level are seen regardless of the noise level.

Lip Reading Test:

Falconer (1966) developed a lip reading test for functional hearing loss cases.

The lip reading test contains auditory as well as visual stimuli. It consists of monosyllabic homophenous words, which are impossible to perceive by lip reading alone.' But the patient is unaware of this, and continues to respond in his usual way to sound and stimuli. As can be expected, the correct responses would be the result of audition and in adverently, the patient reveals some degree of functional hearing loss.

A lip reading test in Kannada language was developed by Subba Rao (1981), and in Hindi by Sadhia (1982).

Bekesy Audiometry:

The use of Bekesy Audiometer has increased dramatically since Jerger and Herer's report (1961). They have reported a type V Bekesy audiogram; which ischaracterized by continuous tones being traced at lower (better) hearing levels than interrupted tones for most of the frequency range.

Hattler (1970) reports that 'Lengthened off time'(LOT) is an efficient screening method for nonorganicity. The LOT test has the effect of increasing the tracing level of interrupted tones for the nonorganic patients. 95% success in identifying functional loss has been reported.

Hood, Campbell and Hutton (1964) have reported that BADGE (Bekesy Ascending Descending Gap Evaluation) is obviously confusing to the patient and therefore, is more useful in the diagnosis of exaggerated hearing threshold (functional hearing loss).

Other- Tests

Alternate Binaural Loudness Balance (ABLB) Test (Automatic) can be used to identify unilateral functional hearing loss (Vyasamurthy, 1972). The rationale of the test is based on the presumption that all unilateral sensori-neural loss cases exhibit complete recruitment (within the limits of ± 20 dB) at high intensity levels irrespective of tone decay on ABLB (automatic) test. At the point of balance, if the hearing level of the tone presented to suspected ear in lower by 20 dB or more functional hearing loss is indicated. However, if no significant difference is seen, i.e. recruitment is present, functional hearing loss cannot be ruled out.

Two methods have been developed by (Vyasamurthy, 1971) using the principle of binaural summation, to disclose unilateral functional hearing loss. One method uses the principle (Hirsh, 1952) that the difference between binaural threshold and monoaural threshold at 35 dB SL in 6 dB. The subject is presented a tone both monoaurally and binaurally at 35 dB SL and is asked to match the two. Another describes 4 expected responses: (a) binaural stimulus weaker than monoaural tone (b) no response (c) binaural tone in louder than monoaural tone and (d) both are similar. First three responses are characteristics of unilateral functional loss. Increase in loudness is expected only when the suspected ear has normal hearing and same threshold as the better ear. The fourth type of response is based on subjective judgements and is a limitation.

The second method is based on another principle (Hirsh, 1952), that the binaural threshold is better than monoural threshold by 3 dB at threshold level. If the patient responds to binaural stimulu the test is positive. However, negative results do not rule out organic loss. Both methods require equal thresholds bilaterally and hence have a limitation.

Objective Test:
Acoustic Impedance measurements:

Concerning pseudohypacusis the greatest value of acoustic impedance measurement in through determination of the middle ear muscle reflex threshold. Obtaining a low SL reflex might suggest the presence of recruitment. But when the SL is very low (5 dB or less), an explanation of loudness recruitment is also not accepted and what should be considered is the nonorganicity (Lamb and Peterson, 1967; Feldman, 1963).

Jerger et al (1974) describe a procedure based on the work of Niemeyer and Sesterhenn (1972) in which the middle ear reflex thresholds for pure tones are compared to those for wideband noise and low and high frequency filtered wide-band noise. In this manner the approximate hearing loss can be determined, as well as the general audiometric pattern. Jerger (1975)calls this procedure SPAR (Sensitivity Prediction from the Acoustic Reflex). Alberti (1970) warns that, in cases where conductive pathology exists caution should be exercised.

Evoked Response Audiometry:

Alberti (1970) called the cortical audiometer the most important instrument in the detection of pseudohypacusis. He finds that results obtained from this technique and from voluntary pure tone testing agree within 10 dB, and recommends that ERA be used not only with uncooperative patients but also for patients who cannot speak English.

BSER has the advantage of the easy application of surface electrodes plus the fact that the response is stable and repeatable (Schulman Galambos and Galambos, 1975).

Electrocochleography:

Procedure involves the recording of VIII cranial nerve action potentials. In this determination of hearing may be made without the conscious cooperation of the patient.

Galvanic Skin Response (GSR):

The primary advantage of thin test is that, the threshold exploration of pseudohypacusis patients, can be made with a high degree of validity and reliability, provided careful methodology is applied. The limitation of the test is that it requires the use of a noxious stimulus (electric shock) and every case cannot be conditioned. It is very difficult to maintain conditioning for longtesting schedules (Newby, 1972; Martin, 1978; Hopkinson, 1973).

Doerfler-Stewart Test:

History and Introduction:

Ordinarily malingering tests do not prove useful in identifying the patient with psychogenic hearing loss, for the evident reason that he reacts as though his hearing loss were real. He usually cannot be tripped up by trickery and it has been found that consistency of response on successive audiometric tests or speech reception tests is not always indicative of an organic hearing loss.

The relative consistency of response so often characteristics of the patients with either functional overlay or solely functional hearing loss may be explained easily. The patient employs a figurative yardstick against which all sounds are gauged consciously, in the case of the malingerer, and unconsciously, in the case of the person with psychogenic loss, the patient constantly applies this yardstick and fails to respond to any sound which is fainter than his self-imposed threshold. As long as he is in a relatively uniform sound environment his yardstick will remain stable. For this reason consistent responses are often obtained in a test situation even though the loss is not an organic one. Tests which take place in a stable sound environment give the patient an opportunity to gauge the proferred stimulus against his unconscious yardstick. Therefore such tests prove relatively useless in isolating psychogenically deaf patients.

The key to the problem of discovering psychogenic loss seems to lie in destroying, or at least disturbing the patients unconscious yardstock, so that he has no reliable means of determining the loudness of the stimulus, and therefore cannot give response on a consistent basis. Following this line of reasoning various attempts were made at Deshon General Hospital to find a technique where by the conscious yardstick of the malingerer and the unconscious yardstick of the psychogenic case could be sufficiently disturbed so that appropriate tests would discriminate between psychogenic and organic hearing loss One procedure emerged as being good enough so that it was incorporated in a formal test for psychological hearing loss. This procedure was developed by Doerfler and Stewart (1946).

The Doerfler-Stewart test was developed during World War II to detect binaural pseudohypacusis. The test compares responses to speech versus noise. The D.S test (Doerfler and Stewart, 1940, Doerfler and Epstein, 1956) has apparently gained wide acceptance as an efficient screening test for functional hearing loss (Davis and Goldstein, 1960; Heller,1955; Newby, 1958; Watson and Tolan, 1949). Menzel (1960) was the only one to have published data on the D.S. tests efficiency. Menzel's data indicate that the D.S. test was positive in 58% of his subjects with functional component. He concludes that the test is ". . . . . .a sensitive detector of nonorganicity". Menzel's data must be interpreted cautiously for a number of reasons. First, his study was not designed specifically to evaluate the efficiency of the D.S. test. Second, he did not specify how the D.S. test was performed. Third, there was no statement on what bases the test was judged positive. Finally, the number of false-positive identifications was not given.

The Doerfler-Stewart test was first standardized on 100 subjects with organic and nonorganic hearing problems (Muth, 1952). In 1956 Epstein and Hopkinson reported a set of norms that had been established in a study of patients with both organic and nonorganic hearing problems. Doerfler and Epstein (1950) reported this test and procedure and norms in a monograph prepared for the Veteran's Administration.

Procedure:

(Doerfler and Epstein, 1950). To do this test the speech audiometer must have the same binaural out put for speech and noise with independent control over attenuation for each of the signals. Both the speech and noise signals should be calibrated separately in terms of 0 dB hearing level. The SRT for spondaic words is used as the reference level for speech. A saw-tooth noise was recommended originally (Doerfler and Stewart, 1946) because the spectrum with base frequency of approximately 125th was believed to be psychologically more noisy than a whitenoise at the game sensation level. A complex noise was substituted by Ventry and Chalkin (1965). "Speech noise" has been as effective as swatooth noise. Although there is not a great deal of formal evidence, it appears that the real strength of the Doerfler-Stewart test does not depend specifically on "the kind of noise, as long as it has strong energy components between 125 and 500 Hz.

Instructions:

The patient is instructed. "I am going to say words to you, words like airplane, cowboy, baseball, out-side etc. My voice will be very faint when you first here me. Just say, the words after me, as soon as you began to hear them".

It is important aot to mention the noise signal. Earphones are placed on the patient and the clinician begans the test immediately. The self assurance with which he administers the test is of significant value in uncovering a pseudohypacusis problem. Each step of the test should be continuous with the next. The equipment should be set for binaural input of both speech and noise signals. The audiologist presents the spondees by live voice, monitoring the volume unit (VU) meter to 0, with equal emphasis on each syllable.

Speech Reception Threshold one (SRT_1 and SRT_1 + 5), SRT_1 is accomplished using an ascending technique. The test begins at 0 dB hearing level (HL) and the intensity is increased in 5 dB steps for each presentation of three spondees. If there has been no response after two or three increments, a few of the words should be repeated, using a tone of voice that suggest the patient might have heard faintly but did not respond. If there is no response, the intensity may be increased in successive 5 dB steps until the patient responds correctly to two out of three spondees. The intensity is then increased another 5 dB. If the patient repeats three out of three words correctly, the previous level is recorded as his speech threshold one (SRT), and the latter increment is recorded as SRT_1 + 5.

Noise Interference Level (NIL):

NIL is established by raising the noise level from o dB HL, as the clinician continues to present spondees at the SRT_1 + 5 dB level. The noise is brought up in 10 dB steps until a level 20 dB below the SRT_1 + 5 is reached. Then the increments may be in steps of 5 dB/spondee until the patient no longer repeats spondees. The point at which he does not repeats spondees. The point at which he does not repeat any of four spondees is the NIL. If the patient reports the presence of the noise, it is important that the clinician say nothing about it, except perhaps to nod so the patient can see that he knows the noise is present. Otherwise the patient may become very distracted, thinking that the equipment is defective. The patient should not be told that the noise is part of the test. The level at which the noise was first mentioned should be recorded separately for future reference.

When the NIL is obtained the intensity level of the speech signal should not be changed. The clinician continues to increase the noise in 5 dB steps giving one spondee at each level until the noise is 15 to 20 dB above NIL. Under the cover of this noise level, the intensity of speech should be lowered in 5 dB steps, presenting one spondee at each decrease. If no words have been repeated by the time the reading is 15 dB below SRT_1 the speech setting need not be reduced further. Rather the noise level can be reduced. The decrease should be in 10 dB steps/spondee until the previously obtained NIL is reached. The noise level then can be reduced in 5 dB steps/spondee until 0 dB HL or less.

Sometimes the pseudohypacusis listener will become confused and will begin repeating these fainter spondee during the decrease in the noise. This now represents the SRT_1 and new NIL should be obtained. A record should be kept of the "bonus response". The results can be kept separately or, if one is able to continue to manipulate the speech and noise while responses continue, then the final set of results may not be positive but may represent the organic level of speech.

Speech Reception Threshold Two (SRT_2):

A second SRT is obtained if no spondees were repeated when the levels of speech and noise signals were reduced. The level is raised 5 dB/three spondaic word until the patient repeats two out of three words.

Noise Detection Threshold (NDT):

NDT is determined following simple instruction to the patient. The intensity of speech should be only as high as necessary (10 dB above the lower SRT). The clinician should allow the patient to see his face. An example of the instruction is as follows; "I am going to put a noise in your ears again. Please raise your hand as soon as you hear the noise, even if it is very faint. Put your hand down when the noise goes away.

The noise should be rechecked for calibration in this part of the test. While the noise is increased from -10 dB HL in 5 dB steps, the clinician should continue to look at the patient. The noise should be interrupted before each increase. After obtaining an ascending, descending and ascending threshold for the noise, the reading is recorded as NDT.

All the levels obtained are recorded on the form as shown below:

Test Data		Inter-test comparison	Results
A SRT_1	D SET_2	$SRT_1 - SRT_2$	+ – – –
E NDT		$SRT_1 - NDT$	– –

Test Data		Inter-test comparison	Results
B	C	SRT_2-NDT	- -
SRT_1+5	NIL		
		SRT_1+5-NIL	--
		NDT-NIL	--

Interpretations:

The norms as they were first reported (Epstein and Hopkinson, 1956? Doerfler and Epstein, 1956) are as follows:

SRT_1 - SRT_2	-	-4 to +5 dB
SRT_1 - NDT		-7 to +15 dB
SRT - NDT		-7 to +15 dB
SRT_1 +5 - NIL		-18 to +3dB
NDT - NIL		-31 to -2dB

Using the original set of norms in a study of the efficiency of the Doerfler-Stewart test, Ventry and Chaiklin (1965) considered the absence of positive (suspicious) difference scores as a negative result; one positive difference score equivocal, and two or more were considered a positive result. If the one positve result on the D.S. test is the NDT-NIL, the clinician may very well have a very important result.

An interrelationship exists among the five measures either became they have measured the same signals, in the same or related context, or they have measured different signals in a threshold context. The first and second speech reception thresholds should relate closely. SRT_1 and SRT_2 have a close association with the dection of noise. Noise interference and speech reception above threshold are relevant to one another. Noise detection and noise interference should correlate.

Menzel (1960) described the efficiency of the D.S. test as a detector of nonorganic hearing loss when it is used early in the battery of tests. He conducted from his work that it was a common occurance for the first speech reception score in the D.S. test to be inflated, but not the monaural SRT that followed the D.S. test. He concluded that the test served as "an important motivational device in discouraging the would be malinger".

Hattler (1971) in an experiment studying the efficiency of the Stenger, D.S, and LOT Bekesy test concluded that LOT Bekesy test could be employed with 79% of the toal 725 patients, the Stenger with 57% and the D.S. test with only 38% of the patients.

Ventry and Chaiklin (1965) questioned the validity of D.S. test. They concluded that norms were too general, the scoring procedure did not adequately differentiate between reliable and unreliable response and the results must be interpreted with considerable caution. This was supported by Marvin (1970).

Doerfler and Epstein recommended that the D.S. test be given as an initial screening test for functional hearing loss in all cases involving compensation. If the results of the test are positive, the examiner is then alerted to the possibility that the patient does have a functional hearing loss and should employ other special tests, such as GSR, to verify the patients thresholds.

Ventry and Chaiklin (1965) strongly recommended that even as a screening device, it is too difficult and complex to administer. Following these findings Pangching (1970) reported a modification of D.S.test. The modification is a simple monoaural procedure, called tone in noise (TIN) test. The TIN test examines the individual's ability to respond to pure tones - in the presence of masking noise. A single sensation level is used and only the difference between thresholds in quite and noise are considered. The TIN test has been reported to be 100% successful in identifying functional hearing loss. The TIN test is said to be advantageous over a monoaural approach by Martin and Hawkins (1963).

METHEDOLOGY

CHAPTER-III

METHEDOLOGY

The study was aimed at establishing norms for D.s.test.

The study was carried out in two parts A and B.

Part-A:

Subiects: 10 adult normal hearing (20 dB HL ANSI 1969) subjects within the age range of 20 to 30 years were selected randomly. The criterion for the selection of subjects was fluency in English language.

Material: English SRT list developed by Swarnalatha (1972) for Indian population was used (Appendix-11).

Part-B:

Subiects: 10 adult normal hearing (20 dB HL ANSI 1969) subjects within the age range of 20 to 30 years were selected randomly. The criterion for the selection of subjects was fluency in Kannada language.

Material: Kannada SRT list developed by Mythili was used (Appendix-11).

In both the experiments (Part A & B) .

Speech Noise was used instead of Saw tooth noise (Doerfler and Stewart, 1946) or 'complex noise (Ventry and Chaiklin 1965)

Speech Noise: Speech Noise in filtered white noise above 1000 Hz at the rate of about 12 dB per octave. Speech Noise provides energy in the low frequency spectrum than white noise.

Apparatus: Beltone 200-C (fig.3.1) calibrated to ANSI specifications was used. The calibration procedure that was used is given in Appendix.I.

Testing Environment: A two room situation was utilized for testing. The testing room was sound treated and the noise levels were within the permissible limits.

Procedure: All the subjects of Part A and Part B were screened at 20 dB HL for Normal Hearing (ANSI 1969).

The procedure followed was same as that described by Doerfler and Epstein (1956), except that this test was administered monoaurally.

Instructions:

The patient was instructed as follows:

" I am going to say some words like . . . . . .Repeat the words as soon as you begin to hear them".

The subjects were not informed about the noise signal.

The equipment was set for monoaural input of both speech and noise signals. The spondees were presented by live voice, monitoring the VU meter to 0.

Speech reception threshold one(SRT_1 and SRT_1+5):

The test was started at 0 dB HL and the intensity was increased in 5 dB stops for each presentation of three spondees. The level/at which the subject repeated 2 out of 3 spondee was considered as SET_1 and SRT_1,+5, is the level at which the subjects repeated 3 out of 3 spondees correctly.

Noise Interference Level (NIL):

Spondee words were presented at (SRT_1+5) dB level and noise was introduced gradually in 5 dB steps starting from -10 dB HL. For every 5 dB increase in noise one spondee was presented. The level at which the subject failed to repeat the word was considered as NIL. The noise level was increased upto NIL+20. Under the cover of this noise, speech level was decreased in 5 dB steps/spondee upto 0 dB HL. Then noise was decreased in 5 dB steps/spondee until 0 dB HL had reached.

Speech Reception Threshold Two (SRT_2):

The intensity level was increased in 5 dB steps, 3 spondees were presented per 5 dB increase, until the subject repeated two out of three words.

Noise Detection Threshold (NDT):

The subject was instructed through earphones, to indicate by raising his finger, as soon as he heard the noise.

The noise level was increased from -10 dB HL in 5 dB steps. The ascending, descending and ascending, thresholds were obtained for the noise. The reading was recorded as NDT.

RESULTS AND DISCUSSIONS

CHAPTER-IV

RESULTS AND DISCUSSIONS

The data obtained were converted to dB SPL values and were subjected to statistical analysis. The mean values of all the measures were calculated separately.

Table 1 shows speech reception threshold, noise detection threshold, and noise interference level, for 10 subjects (for English list). Table 2 shows the same for Kannada list.

In the second step, the values SRT_1 - SRT_2, SRT_2 - NDT, SRT_2 - NDT, (SRT_1+5) - NDT , NIL - NDT, were calculated for each subject. The highest and the lowest values obtained were noted down. These values are shown in tables 3 (for English list) and 4 (for Kannada list).

Table-1: Showing speech reception threshold, noise detection threshold and noise interference level for 10 subjects (for English list)

Sl. No.	SRT_1	SRT_2	SRT_1+5	NDT	NIL
1	25	30	30	35	45
2.	35	35	40	35	50
3.	35	35	40	35	50
4.	40	35	45	35	60
5.	35	30	40	36	55
6.	20	25	30	25	40
7.	30	30	35	30	50
8.	40	35	45	40	50
9.	30	40	35	30	50
10.	30	25	35	30	60
Total	320	320	375	325	520
Mean	32	32	37.5	32.5	52.0

Table-2: Showing speech reception threshold, noise detection threshold and noise interference level for 10 subjects (for Kannada list).

Sl.No.	SRT_1	SRT_2	$SRT_1 + 5$	NDT	NIL
1.	30	35	35	35	50
2.	30	35	35	35	50
3.	25	30	30	35	40
4.	30	30	35	30	50
5.	25	25	30	30	45
6.	30	30	40	30	50
7.	30	30	35	35	50
8	30	30	35	30	50
9	30	25	35	30	50
10	40	40	45	35	55
Total	300	310	355	320	490
Mean	30.0	31.0	35.5	32.0	49.0

Table-3: The difference among SRT, NDT and NIL (English list)

Sl.No.	SRT_1-SRT_2	SRT_2-NDT	SRT_2-NDT	(SRT_1-5)-NIL	NIL-NDT
1.	-5	-10	-5	-15	10
2.	0	0	0	-10	
3.	0	0	0	-10	15
4.	5	5	0	-15	15 25
5.	5	5	0	-15	25
6.	-5	-5	0	-10	15
7.	9	0	0	-15	20
8.	5	0	-5	-15	20
9.	-10	0	-10	-15	20
10.	5	0	-5	-25	30
Range	-5 to +5	-10 to +5	-5 to +10	-25 to -10	+10 to +30

Table-4: The differences among SRT, NDT and NIL (Kannada list)

Sl. No.	SRT_1-SRT_2	SRT_1-NDT	SRT_2-NDT	SRT_1+5-NIL	NIL-NDT
1.	-5	-5	0	-15	+15
2.	-5	-5	0	-15	15
3.	-5	-10	-5	-10	5
4.	0	0	0	-15	20
5.	0	-5	-5	-15	15
6.	0	0	0	-10	20
7.	5	0	-5	-15	20
8.	0	-5	-5	-15	15
9.	0	0	0	-15	20
10.	0	+5	+5	-10	29
Range	-5 to +45	-10 to +5	-5 to +5	-15 to -10	45 tp 420

-

From Table 1 and 2 it is clear that an interrelationship exists among the five measures because the same signals were measured in the same or related context.

The first and the second SET (SRT_1 and SRT_2) relate closely. Their mean values are almost the same SRT_1 and SRT_2 have a close association with the detection of noise (NDT).

Doerfler and Stewart have stated that the persons with normal hearing or organic losses are able to hear and repeat speech correctly until the simultaneously presented noise exceed the speech level by 10-25 sensation units. In this study also the level varied from 10 to 25 sensation units. So, noise interference level and speech reception (SRT_1+ 5) are relevant to one another.

The relationships between these measurements are used as the basis for identifying the cases of psychological deafness or functional overlay. Specifically, one or more of the following conditions raise the suspicion that the patient exhibits non-organic loss (Doerfler and Stewart).

1) When speech reception is inhibited by a noise interference level less intense than the speech presentation level.

2) When the noise perception threshold is poorer than the speech reception threshold.

3) When there is a sharp discrepancy between the two speech thresholds.

The normative scores obtained in this study are given below

	English	Kannada
SRT_1 - SRT_2	-5 to +5 dB	-5 to +5 dB
SRT_1 - NDT	+10 to +5 dB	-10 to +5 dB
SRT_2 - NDT	-5 to +10 dB	-5 to +5 dB
SRT_1 +5 - NIL	-25 to -10 dB	-15 to -10 dB
NIL - NDT	-10 to + 30 dB	+5 to +20 dB

SUMMARY AND CONCLUSIONS

CHAPTER - V

SUMMARY AND CONCLUSIONS

Based on Doerfler and Stewart (1946) test for pseudohypacusis a study was conducted for establishing norms for monoaural D-S test using English and Kannada SRT lists. Ten normal hearing subjects were tested for each condition.

The normative scores obtained in this study are as follows:-

	English	Kannada	The data re-parted by Doerfler Epstein
SRT_1 - SRT_2	-5 to +5 dB	-5 to +5 dB	-4 to +5 dB
SRT_1 - NOT	-10 to +5 dB	-10 to + 5 dB	-7 to +15 dB
SRT_2 - NDT	-5 to + 10 dB	-5 to +5 dB	-7 to +15 dB
SRT +5 - NIL	-25 to -10 dB	-15 to -10 dB	-18 to +3 dB
NIL_1 - NDT	+10 to +30 dB	+5 to +20 dB	-31 to -2 dB (NDT - NIL)

CONCLUSIONS

These norms can be used to differentiate pseudohypacusis cases from organic hearing loss cases.

RECOMMENDATIONS:

1. More number of normals and organic hearing loss patients may be tested to validate this study.

2. The norms may be used on pseudohypacusis patients.

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BIBLIOGRAPHY

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APPENDIX

APPENDIX-1

CALIBRATION:

The following procedure was adopted for the calibration of the audiometer (Beltone 200-C) for puretones, speech and noise.

For intensity calibration purposes, the test earphone TDH-49 of the audiometer was coupled to an artificial ear (B&K 4153) and SLM (B&K 2203) with its associated Octave band filterset. The attenuator was set at 60 dB HTL. The output of the SLM was checked from 250 to 8000Hz. All the readings were within the normal limits.

SPEECH NOISE CALIBRATION:

With the same set up the output of speech noise at 80 dB 60 dB HL was noted. The output at 60 dB HL was equal to 80 dB HL it was equal to 100 dB SPL.

SPEECH AUDIOMETER CALIBRATION:

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

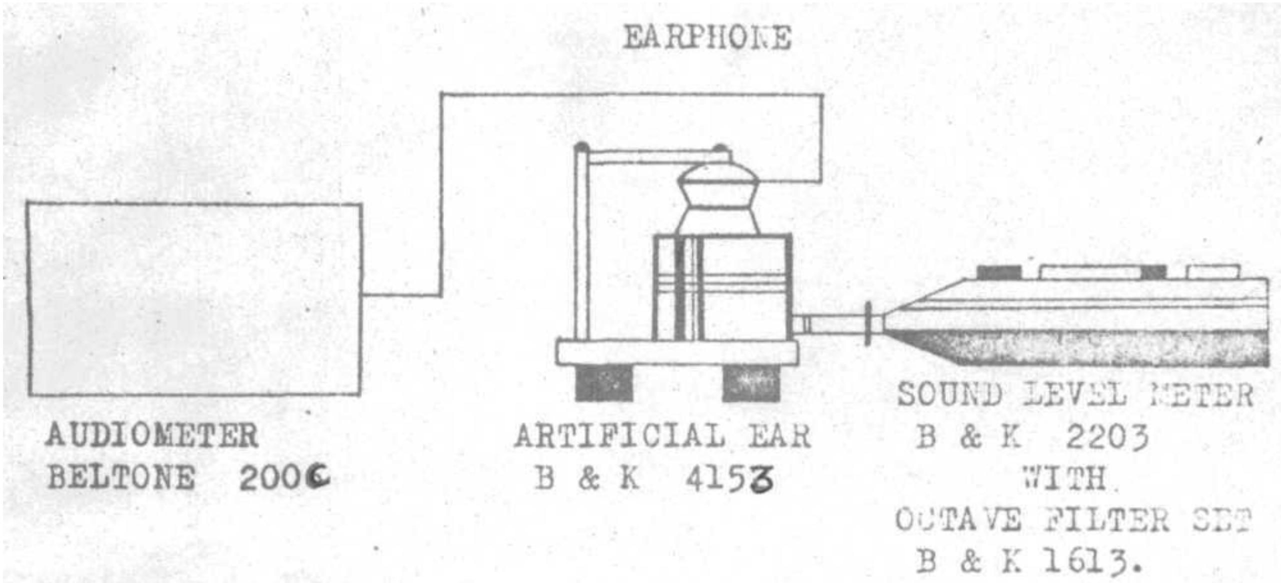

Fig.3:- Block Diagram of Pure Tone and Speech Noise Calibration

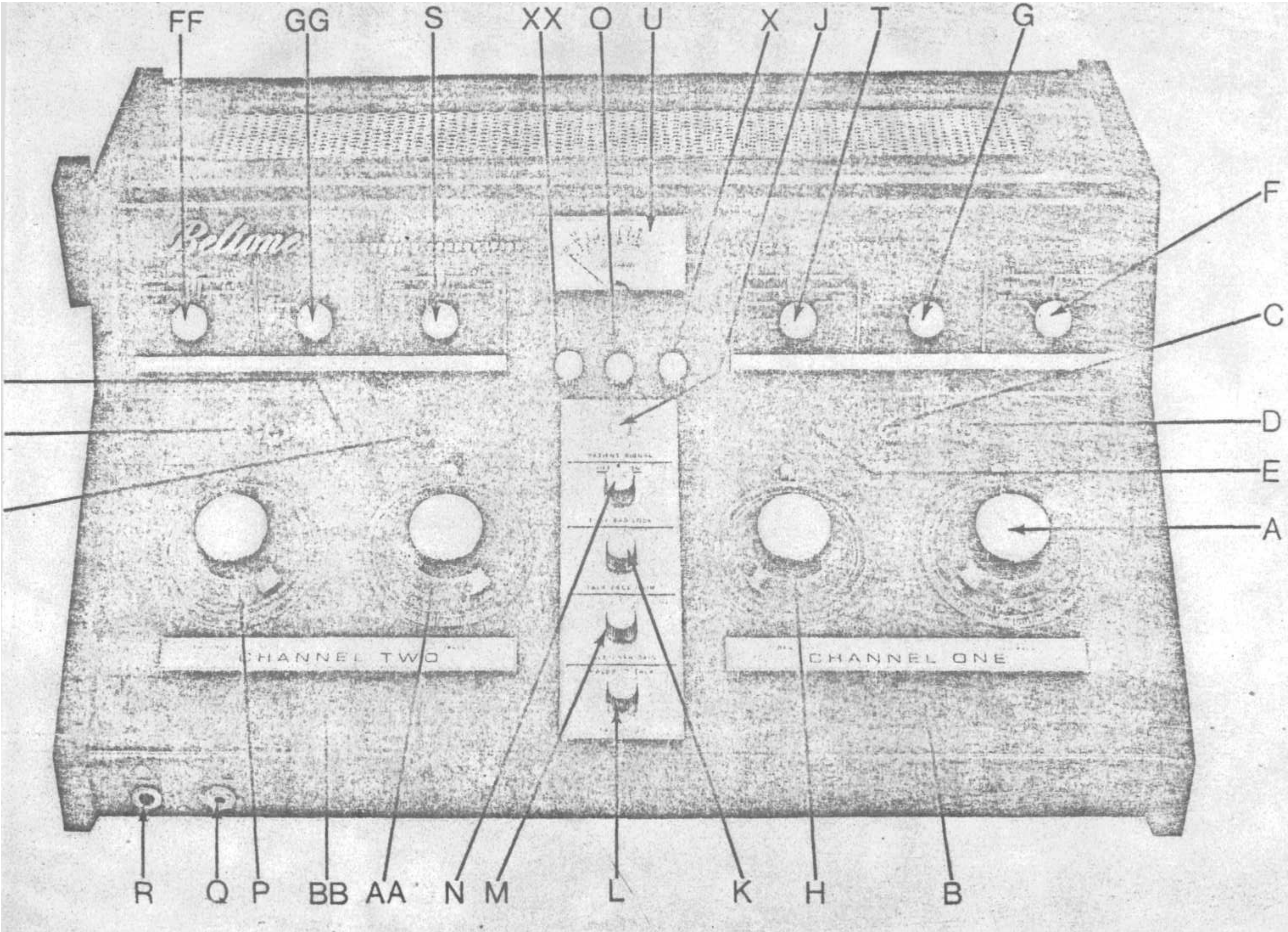

FIGURE 3.1 ILLUSTRATION, OPERATING CONTROLS

FRONT PANEL INDICATORS, CONTROL KNOBS OF BELTONE 200-C

A, (AA)	..	Output (Hearing level control)
B, (BB)	..	Tone Interruptor
C, (CC)	..	Tone 'on' lamp.
D, (DD)	..	Automatic/Manual switch.
E, (EE)	..	Tone reversing switch
F, (FF)	..	Out put selector
G, (GG)	..	Monitor control
H	..	Frequency
J	..	Patient signal lamp
K	..	Talk back gain
L	..	Talk over switch
M	..	Talk over gain
N	..	Tone Bar Lock
0	..	VU Meter selector switch
P	..	Frequency input
Q	..	Monitor ear phone
R	..	Power
S	..	Speech Unit
T	..	SISI
U	..	VU Meter
X	..	Channel one VU meter gain control
XX	..	Channel two VU meter gain control

APPENDIX-2

SPONDEE LIST-I:

1. Sunset
2. Playground
3. Workshop
4. Birthday
5. Outside
6. Starlight
7. Whitewash
8. Blackboard
9. Housework
10. Although
11. Farewell
12. Daybreak
13. Muschroom
14. Northwest
15. Playmate
16. Doorstop
17. Earthquake
18. Lifeboat
19. Sendown
20. Stairway
21. Armchair
22. Hardwork
23. Outlaw
24. Cargo
25. Doormat.

SPONDEE LIST-II

1. Therefore
2. Toothbrush
3. Bar bone
4. Blave out
5. Schoolboy
6. Grandson
7. Airplane
8. Railroad
9. Platform
10. Eyebrow
11. Woodwork
12. Headlight
13. Midway
14. Beehire
15. Pancake
16. Cowboy
17. Watchword
18. Padlock
19. Shipwreck
20. Eardrum
21. Coughtdrop
22. Yardstick
23. Cupcake
24. Cookbook
25. Horsesho

KANNADA LIST

1 ಮರ—ಗಿಡ
2 ಕಲ್ಲು—ಮಣ್ಣು
3 ತಾಯಿ—ತಂದೆ
4 ಗಂಟು—ಮೂಟೆ
5 ಅಂದ—ಚೆಂದ
6 ಅತ್ತ—ಇತ್ತ
7 ಸುತ್ತ—ಮುತ್ತ
8 ಮನೆ—ಮಠ
9 ಹೊಲ—ಗದ್ದೆ
10 ಹೊಟ್ಟೆ—ಬಟ್ಟೆ
11 ಬೆಟ್ಟ—ಗುಡ್ಡ
12 ನಡೆ—ನುಡಿ
13 ಈಗ—ಆಗ
14 ನಮ್ಮ—ನಿಮ್ಮ
15 ಬೇಳೆ—ಕಾಳು
16 ಅಲ್ಲಿ—ಇಲ್ಲಿ
17 ಗೆಜ್ಜೆ—ಪೂಜೆ
18 ವಿಲಾಸ—ವೇಷ
19 ಕಷ್ಟ—ಸುಖ
20 ಆಸ್ತಿ—ಪಾಸ್ತಿ
21 ಕೆಲಸ—ಕಾರ್ಯ
22 ಗುರು—ಶಿಷ್ಯ
23 ದಾನ—ಧರ್ಮ
24 ಕನಸು—ನನಸು
25 ಪಶು—ಪಕ್ಷಿ
26 ಬಂಧು—ಬಳಗ