DEVELOPMENT AND STANDARDIZATION

OF

TIME-COMPRESSED SSI TEST

Independent project

Submitted in part fulfilment of the Degree of Master of Science (Speech and Hearing)

UNIVERSITY OF MYSORE

1983

C E R T I F I C A T E

This is to certify that the Independent Project entitled "Development and Standardization of Time-Compressed SSI Test" is the bonafied work in pert fulfilment for the Degree of Master of Science (Speech and Hearing) of the student with Register No.

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CERTIFICATE

This is to certify that this Independent Project has been prepared under my supervision and guidance.

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D E C L A R A T I 0 N

This Independent Project entitled "The Development and Standardization of Time-Compressed SSI Test" is the result of my own study undertaken under the guidance of Mr.M.N.Vyasamurthy, Lecturer in Audiology and has not been submitted earlier at any University or Institution for any other Diploma or Degree.

Mysore.

Reg.NO. 10

Date:

A C K N O W L E D G E M E N T S

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C 0 N T E N T S

CHAPTER - I

INTRODUCTION

A useful aphorism concerning the central nervous system is "Everything is very much complicated than we can readily conceive". As we proceed inward from the sense organ into the central nervous system, both the anatomy and the physiology suddenly become much more complicated. (Davis, 1978)

The auditory system appears to be continually refining auditory information from the time a signal enters the ear canal until it is processed in, the brain. Therefore, setting up very specific criteria for peripheral and central function are difficult to make with precision. System up to and including cranial nerve 8th is peripheral system and the brain stem and brain is the central system.

The tests can make distinctions within the peripheral system and can also make distinctions in the central portion. Auditory tests can divide pathologic responses into atleast four groups: conductive, cochlear, retrocochlear and central (Katz, 1978).

The peripheral auditory mechanism lesion at any point along the system results in reduced auditory sensitivity, represented by decreased thresholds for pure tones and speech. Even the simple coding system required for inhibiting the reflex will be disrupted by CNS damage (Northern and Downs, 1978).

Although it is possible to evoke, even at superior levels along with auditory pathway, a differential response to intensity and frequency, this response becomes less and less precise as one moves up from the periphery towards the higher centers. The preception of a sound message does not really depend as such upon a choice between single elements, rather it depends on a choice between integrated groups of elements, as against choice grouping. The central auditory function consists precisely into a definite pattern.

The integration, at the central level, of the sound form is due to the use of different repefoire, which concerns above all the dynamic fluctuation in the durations, the intensive and the frequencies in field which is probably a spatial one.

Just as a verbal message is rapidly structured, so is the pattern of activity provoked by the message at the level of auditory stations and centers. At this level, too, there is certainly a redundancy based on a criterion of order in the succession and distribution of the incoming stimuli, guaranteed by the multiplicity of paths and by the synaptic interrelation between afferent and efferent paths.

This redundancy, which might be called as intrinsic redundancy, as opposed to that inherent in the message which is called extrinsic, allouis there patterns of neural activity to be differentiated from one another even when a greater or lesser proportion of the nerve elements has been put out of action. (Bocca and Calearo, 1963)

The traditional audiometric technique, provide site of lesion information in hearing loss cases. However, these techniques are much less useful in locating disorders of central auditory nervous system (CANS). The neural fibers from each cochela are represented bilaterally in the system central to the cochelear nuclei. There are

numerous commissural connections at various levels in the auditory neuroanatomy. This arrangement provides for duplicate information in various parts of the system which is referred to as intrinsic redundancy. (Stevens. 1978)

As a consequence, the investigation of functional disturbances at the level of central auditory system should be based upon the evaluation of disorders of pattern formation and integration, by means of appropriate test matenal, and not upon the capacity to discriminate between single sound elements. (Bacca and Calearo, 1963).

The rationale for developing the battery of tests was to present a series of tests that were known to challenge the integrity of the CANS at several levels. The basic assumption underlying this rationale is that all levels of CANS might be equally vulnerable to damage or disease. In that event, a test which looked only at the function in a given region of the CANS might not identify a problem at some other site in the system. Performing the auditery tests primarily for the purpose of helping

to identify the site and the nature of lesions is not the sin.

Tests like pure-tone audiometry. Speech Audiometry, ABLB, SISI, Bekesy etc,are useful in detecting peripheral lesion (Willeford 1969).

Beasley and Shriner (1973) say that stimuli such as puretones, clicks, digits and words, if undistorted, fowl to adequately assess the function of the central auditory pathways.

In recent years it has became increasingly apparent that pure-tone tests are of little diognostic value for isolating site of lesion in the central auditory pathway. Although the theoritical basis of speech tests presume the use of structured message sensitive enough to test the functional properties of the central auditory system, conventional speech audiometry has failed to show abnormally reduced monosyllabic word discrimination scenes in audio-specific disturbances above the cochlear nuclei (Schwartz and Mikus, 1977).

By contrast, however, lesions in the brain-stem and auditory cortex rather consistently elude detection by existing audiometric measures. Individuals with such disorders usually exhibit response behaviour which appears esentially the same as that observed in normal subjects. The general conclusion which has been drawn from such results in that conventional auditory tests apparently lack the structuring and sensitivity necessary for identifying lesions in the higher auditory centers. The more centrally the lesion is located the more subtle is its auditory manifestation. Diagnostic tests of auditory behaviour is not sufficiently challenging to the functional integrity of the higher auditory centers (Willeford, 1969).

Investigators have indicated that conventional methods of measurement used in evaluating auditory abilities are inadequate for the assessment of the central auditory processing systems for adults (Bocca and Calearo 1963; Hodgson, 1972) and Children (Maki et al., 1974). In order to adequately assess the integrity of the higher auditory pathways, measures of increased complexity which nessiate subtle perceptual decisions on the part of the listener are required (Miller 1965).

The human auditory system with temporal lobe lesion is capable of transmitting and processing. Simple P-T signals and conventional speech material, but this function breaks down when speech stimuli are presented in an unusual manner. (Willeford, 1969)

Increased speech signal complexity has been accomplished by such means as filtering and time compression (Beasley et al, 1972, Maki et al, 1974) While these methods have been found useful in diagnostic audiology (Kurdziel and Noffsinger, 1973, Kurdziel et al, 1975, Konkle et al, 1974, Orchik and Oelschlager, 1974).

Recognizing the limitations of traditional audiometric proceedures investigators have abandoned these techniques in favour of specially designed measures which demand cortical integration of complex signals in order for the subject to respond appropriately.

A goal common to all present efforts is to reduce the redundancy of verbal stimuli in some way. In doing so, the subtlety of the auditory task is

increased and a greater challenge for the integrative processes of these higher centers is presented. The speech is known to be a highly redundant phenomenon, patient C CANS problem apparently utilizes the normally superfluous information to compensate for pathological deficit so that he is not at a disadvantage when taking standard auditory tests. When the redundancy of the message is reduced to the point where he can no longer compensate adequately, his test performance suffers in a unique fashion (Willeford, 1969).

Keeping the above mentioned facts in mind the present study was undertaken to develop and standardize accelerated (time-compressed) SSI test. Synthetic sentences reported by Speak and Jerger (1965) were used as speech materials. These sentences were recorded and played back at different speeds. The sentences which were played back at different speeds were again recorded. These recorded sentences were used as time-compressed (accelerated) SSI sentences and they were presented to normal hearing subjects to determine their performance.

CHAPTER - II

REVIEW OF LITERATURE

This chapter deals with a review of literature concerning time-compressed speech and Synthetic Sentence Identification.

Intelligibility Factor

Effect of sensation level and time compression ratio:

A pair of independent message-test units, each consisting of an extended exposition of technical information and a corresponding test of factual comprehension, were developed by Fairbonks et al., 1957. The messages were read by an experienced speaker at 141 wpm, recorded, and compressed automatically in time by various amounts. Independent groups of subjects were assigned to 5 experimental conditions which represented a series compressions ranging from 0 to 70% and to a 6th test-only condition in which no message was presented. The curve of comprehension as a function of message time was characteristically sigmoid. Response was approximately 50% of maximum when message time was 40% (60% compression 353 wpm). When message time was 50% (282 wpm), the

response was slightly less than 90% and efficiency, response per time, was manimal. Results indicated that time-compression, listener aptitude and message effectiveness all affect factual comprehension significantly, and afforded evidence that interaction of time-compression and message effectiveness in tne expected direction is significant.

The effects of time-compressed speech on the auditory discrimination abilities of 96 normal-hearing young adults were studied by Schwimmer et al. (1971). There were five conditions of time compression, 30% through 70% in 10% steps, plus a 0% control condition. Each of these was presented at 4 sensation levels (8, 16, 24, and 32 dB). The results revealed an apparent trading relationship between sensation level and time-compression ratio.

NV test No.6 was compressed and was presented to 16 right handed subjects with the age range 18-26 years. All had normal hearing, stimulus was presented at 40 dB SL under six conditions of time compression. Test ear and time compression was randomized while list presentation was counter balanced. Intelligibility decreased to about 80% as time-compression ratio increased to 70%

List effects were negligible except at 70% compression (Beasley, Formar Rintelmann 1972).

The effects of time-compressed monosyllabic CNCs on the auditory discrimination was studied by Beasley Schuimner, Rintelmann (1972),96 young adults with normal hearing were studied. 5 conditions of time-compression 30% through 70% in 10% steps, plus a o%. Control condition were presented at 4 sensation levels (8, 16, 24 and 32 dB). Ear presentation and list version were counter balanced with these factors. Results indicated that intelligibility was inversely related to time-compression ratio and directly related to SL, ear and list effects were minimal.

Two measurer, the word intelligibility by picture identification (WIPI) test and the phonetically balanced Kindergarden (PBK-50) lists were administered to 60 normal hearing children. The effects of time-compression, age, sensation level, and test measure were investigated. Percentage correct scores improved as age and sensation level increased, and scores decreased with increasing time-compression. Scores on the Wlpl were consistently higher and showed a smaller range than the PBK-50 (Maki 1974).

The intelligibility of time-compressed CNC monosyllables was studied by Nikam et al., (1976) using English speaker/listeners whose native languages were Spanish or Indo-Dravidian. Subjects were 72 native speaker/listener of Indo-Dravidian languages (mean age 24 years) 72 Mexican-Americal native speaker/listeners of Spanish (mean age 22 years) with normal hearing. Used six time-compressed version of (0 and 30% through 70% in 10% steps) NU Auditory test No.6. The time-compression was presented randomly and the sensation levels were randomized. Results showed that intelligibility decreased as a function of increasing percentage of time compression and decreasing sensation level. This effect was more prominent for the Indo-Dravidian than for Spanish speaker/listeners. The Spanish group of subjects showed generally lower difference score than did the Indo-Dravidian group when compared to native English speaker/listeners.

Performance of normal-hearing listeners on the Time-compressed modified Rhyme test was studied by Schwaitz and Mikus (1977). Subjects were 60 young normal hearing adults (19 males and 41 females). Age range 17 to

30 years. All had normal hearing with no previous experience Results showed that word discrimination decreased as a function of increasing percentage of time compression. Differences among the 6 lists were found to exist at high levels of time alteration.

The study by Sunil Kumar Sood (1981) reports on the performance of 40 young adults on time-compressed version of 4 lists of form B of NV No.6 recorded in foreign accent. All subjects had normal hearing with the age range from 17 to 23 years. Time compression levels of 0 and 60% was used at 5 sensation levels (8, 16, 23, 32 and 40 dB). The results showed that the performance decreased at higher time compression and increased with increasing sensation level.

Effect of sentence level

Several investigators have discussed the limitations of monosyllabic speech discrimination tasks and consequently have developed test stimuli of a sentential nature (Beasley and Freeman 1977).

Speaks and Jerger (1965) gave a new method for measuring speech identification behaviour. Twenty-four closed-message sets representing three levels of approximation to a real sentence was constructed. The message sets contain synthetic sentences constructed as approximations to 'real' sentences solely on the basis of the conditional probabilities of word sequences. Each message set is closed of controlled length and controlled relative informational content. The testing procedure is automated permitting rapid data acquisition and storage. 30 subjects were tested in a variety of experimental conditions. Results show that as the amount of information in the artifial sentence decreases, subject performance improves. This relation exists both when the message is low-pass filtered and when it is periodically interrupted. This approach is useful in many experimental conditions particularly those involving the manipulation of temporal parameters.

The effects of frequency filtering on intelligibility of synthetic sentences were studied by Speaks (1967). The effects were studied on three normal hearing

listeners. Performance - intensity functions were defined for several low pass and high pass frequency bands. The data were analyzed to determine the interactions of signal level and frequency range on performance. The results showed the importance of low frequency. The contribution of energy over 1000 Hz seemed negligible. The low frequency cut off frequency extended downward about 300 Hz before no further benefit is derived. The test materials were dependent upon the signal level. No matter how restricted the frequency range was performance could be raised from 25% to 98% by a relatively small increase in signal level. The results also suggest that important frequency for identification of sentences lie in a much lower region, than would be predicted by single word intelligibility tests. The important frequency for identification of material was 725 Hz.

Time-compressed monosyllables have been studied relative to the assessment of central auditory disorders. In certain instances, sentential stimuli may be more useful than word lists in central auditory testing, particularly when results may be contaminated by concomitant peripheral hearing losses (Beasley et al.,

1980). In their study CID and revised CID sentence lists which had a contrived sentential approximation task were presented to 96 normal hearing young adults at time compression ratios of 0%, 40%, 60% and 70%, tinder sensation levels of 24 and 40 dB. The CID and RCID stimuli were more intelligible than the sentential approximations.

Kopra et al (1968) compared the Fairbanks Rhyme test and CID auditory Test W-22 in normal and hearing impaired listeners. 15 listeners with SN hg loss and 15 normal listeners were administered the Fairbanks Rhyme test and CID Auditory test W-22 at -4, 0 8, 16, 24, 32 and 40 dB sensation levels. The results suggest that the W-22 is less variable than FBRI for normals while FBR is slightly less variable than the . W-22 for SN hearing loss cases. Both exhibited minimal variability at high intensities for normals. The articulation functions for the two tests were similar for the two groups of listeners. Te two tests appear equal in ability to differentiate normals from SN loss cases. It is suggested that certain nonessential advantages of Rhyme test may make it preferable to CID Auditory test

test w-22.

Beasley, Shriner (1973) did the auditory analysis of temporally distorted sentential approximations. Two factors important in this process were word duration and interstimulus interval. This study was designed to investigate the perceptual consequences of independent modification of these two factors using two orders of sentential approximations. The results show that while both temporal factors operation in perceptual accuracy, word duration plays a more significant role than interstimulus internal. Also, perceptual errors may be offset by increasing the order of sentential approximation.

In 1976, Beasley and Rintelmann studied children's perception of temporally distorted sentential approximations of varying length. Subjects were 30 second grade 30 fourth grade normal hearing children, with normal speech and language. The material consisted of 10 three-word and 10 five-word normal sentences, 10 three-word and 10 five-word first-order and 10 three-word and 10 five-word

second-order sentential approximations. 20 children were assigned randomly to the 200 ms interstimula internal (ISI) condition and 20 to the unaltered condition. The intensity was set at 70-75 dB SPL. It was found that as order of sentential approximations to full grammatical sentences increased, recall accuracy increased. Recall accuracy scores decreased as sentence length increased from 3 word to five words. As the silent ISI ratios increased the number of items correctly recalled decreased. For all measures, as grade level increased percentage correct scores improved.

In 1977 Freeman and Church investigated the performance of a group of normal young adults on time compressed 5 word first-order sentential approximations. The subjects were 40 normal hearing young adults. They had normal hearing. 10 subjects were randomly assigned to 0% time-compressed condition 10 to 20% condition, 10 to 40% conditions, and 10 to 60% condition. The subjects received each list at one of 4 sensation levels: 16, 24, 32 or 40 dB SL. The order of presentation of the lists

to avoid possible order effects. An equal number of left and right ears were used. Results suggest that there were no difference between lists. The recall and repetition of the time-compressed stimuli was facilitated by an increase in presentation level.

These measures have been developed in an attempt to increase the sensitivity of the audiological battery to problems associated with central auditory - processing. Locke (1968) has suggested that a discrimination impairment may be a by-product of, or co-exist with, an auditory memory deficit. Thus the use of sentential stimuli permits the simultaneous assessment of auditory discrimination as well as "auditory memory". That is, when sentential stimuli are used, the clinician can score the number of items correctly recalled, and, further, can obtain independent scores on errors of order, discrimination, omission, and addition.

Age and sex difference

Children from five years of age and adults may be tested. Peripheral hearing losses may be present theoritically this test may also be used with persons

having a unilateral hearing loss, but the effect of masking en compressed materials is not documented in the literature (Dempsey 1978).

The responses of 18 Spanish American wax veterans to compressed and expanded PB word lists were compared by Luterman et al (1966) in their attempt to study the responses of aged males to time altered speech stimuli. They used two control groups composed of young hard - of - hearing subjects and young normal subjects. The responses were obtained at two levels of compression 10% and 20% and two levels of expansion, 10% and 20%. All subjects in this study responded in a similar manner to the time altered material. Neither the experimental nor the control groups' discrimination ability improved with expanded speech or at standard or increased response time interval. Both levels of speech compression were deteimental to subject's periormances relative to the unaltered condition. The 4 sec interval between presentation items on recorded speech appeared to be adequate for testing the hearing of aged subjects.

Schokers et al., (1973) studied the auditory assembly of segmented sentences by children. Imitative

performance on an assembly task consisting of 6 sentences 4-9 words in length, in which words in the sentences were separated by one of 4 conditions of pause time (silent intervals of 125, 250, 500 and 750 M sec) was compared to performance on the same six sentences spoken normally (N) tape recordings of these five conditions were played to 75 preschool children instructed to repeat them. Results suggest that insertion of silent intervals in sentences does not overwhelm the child's perceptual mechanism children were able to encode the disrupted stimulus with normal intonation prosodic patterns. Error patterns vary regularly with sentence length and lexical item-type in normal and interrupted sentences. The author says segmented sentences, as he perceives and reproduces them, do reflect upon a child's knowledge of grammar. Silent intervals do make echoic behaviour more difficult.

In 1973 Thompson studied the ability of normal children, between five and a half and nine and a half years of age to comprehend 40 sentences presented at four speaking rates, and 10 levels of linguistic complexity. 4 groups of 90 subjects equally divided with regard to sex, listened to the tape-recorded sentences

and indicated responses on a picture selection task. Results showed better comprehension (1) for females (2) with increasing age and (3) as rate is reduced.

The perceptual ability of aged subjects (54 to 75 years and older) with essential normal peripheral hearing function was studied by Konkle and Bess in 1974. CNC monosyllabic words, time-compressed by 0%, 20%, 40% and 60% were presented at 3 sensation levels (24, 32, and 40 dB) to an equal number of right and left ears. The perceptual process of aged persons appears to break down as a function of increased compression ratio and of increasing age.

King and Weston (1974) studied the ability of children to recall electro-mechanically time-compressed three- five- and seven-, word sentences. They found that younger children had significantly more difficulty recalling sencences time compressed by 50% of the original time than older children, particularly on the longer sentences. They suggested that younger children, unlike older children, have not fully developed all the necessary strategies used in the perceptual processing of language, and consequently

they need the normal word durations and interstimulus intervals for accurate perceptual processing.

Orchik and Estrode (1976) examined time-compressed speech discrimination in Kinder-garden-age Children grouped according to scores on the Lindomood Auditory comprehension (LAC) test. In phase one, 34 children were equally divided into two groups based upon the LAC, and administered the word intelligibility by picture identification (W1P1) at 0.30 and 60% time-compression. In phase two, 32 children were similarly grouped and administered the W1P1 of 0 and 30% C 60% time-compression administered first. Significant effects for time-compression and test group were found.

The effects of time-expanded monosyllabic words on the auditory discrimination performance of young adults and elderly subjects were studied by Korabic et al., in 1976. For the normal hearing subjects, intelligibility at all levels of time compression used (30, 60 and 100%) was equal to 0% conrol condition and directly related to sensation level. Results with the elderly subjects indicated intelligibility was inversely related

to time expansion at the 30 and 60% condition. However, at the 100% condition intelligibility improved over the 60% condition at low sensation levels. Maki et al., in (1976) studied the speech discrimination ability and response latency of normal - hearing and impaired children as a function of time-compression. The time-compressed word lists were presented to 60 normal hearing and 20 hearing impaired children and response accuracy and mean reaction time date were collected. Main effects for both measures were found for age and time-compression for the normal group. For the hearing impaired group, discrimination scores were lower and response times longer than normal; however, performance across time compression levels was similar to the normal group.

Orchik and Oelschlaeger (1977) studied the time-compressed speech discrimination in children and its relationship, to articulation. The word intelligibility by W1P1 test of speech discrimination was time-compressed at 0,30 and 60% and administered to 48 normal hearing children. The children all between the ages of 5 years, 6 months and 6 years, 7 months of age, were equally divided into 3 groups on the basis of articulation ability. Significant effects were found for test groups and level of time-compressmn, with differences increasing

as time-compression increased. The implication is that children with multiple articulation errors demonstrate a developmental lag in the ability to process time-compressed speech. So the authors came to the conclusion that speech may be a useful tool in the study of auditory perception in children.

Konkle et al., (1977) studied the intelligibility of time-altered speech in relation to chronological aged. NV-6 measure of speech discrimination was time-compressed and presented to four age groups ranging from 54 to 84 years of age. Experimental stimuli presented at sensation levels of 24, 32 and 40 dB to an equal number of right and left ears and males and female subjects. Results indicated that intelligibility decreased as a function of increasing time compression and age and decreasing sensation level. Changes in speech intelligibility associated with the aging process appear to be closely allied to changes in the temporal resolving power of the central auditory processing system.

The preferred listening rate of speech was investigated in 30 men and 30 women age 18-27 years, by

Riensche et al., (1979). Subjects were presented auditorilly a reading of a standard passage and themselves adjusted a varispeech 1 time compression/time expansion to yield preferred listening rate. There was a trend for the mean rate of preference to decrease with increasing age, except for the eldest group which showed a slight increase in preferred listening rate. Significant age but not sex difference was found, although there was a trend for males in the two youngest age groups to prefer slightly faster listeners rates than the females. Results support previous studies of auditory perceptual difference with increasing age and suggest that variability in previous reports of preferred listening rates may have been due in part to age differences of the subjects.

Effect of Last

Using CID W.22 it was found that the test did not effectively differentiate between normal and SN, young and aged. This has been studied by Latterman et al. (1966) and Sticht andGray (1969) with NV-6, difference increased with difficulty in listening task (Beasely et al 1976. Beasley deviced closed response task W1P1 and a

open response set PB-K. Results were easier with close response than open response. So PB-K for older and WIPI for younger children was advised, and also for difficult to test. WIPI at 60% compression yielded mean correct scores at 16 dB SL better than PB-K at 32 dB SL.

At 32 dB SL 4 year old WIPI group performed same as 8 year old PB-K group at 60% compression rate. Manning et al., (1975) did the analysis of Half-list scores on the PB-K 50 as a function of time-compression and age. Half-list speech discrimination measures have certain advantages in clinical measurement, particularly with children. In this study, half list and whole-list comparisons of the PB-K 50 measure under normal and time compressed conditions were made on children's speech discrimination scores. Results showed no significant main effect or interaction differences between the first-half and second half-lists. There was no significant list differences associated with age. There was no significant difference between the first-half scores and the whole-list scores. Results indicated that half-lists of the PB-K 50 can be used effectively in clinical setting.

Degraded sentential stimuli apparently exhibit sufficient stability to tax central auditory integrative function while withstanding peripheral contamination of test results. The literature provides theoritical and diagnostic bases for the use of temporal distertion, particularly time compression, to degrade speech-signals, 3 time-compressed sentential tests were administered by Bratt (1976) to 96 normal hearing subjects. Findings suggested that time-compressed sentences were more stable than time compressed monosyllables supported the effectiveness of time-compression as a means of signal degradation, and provided normative data.

Effects of lesion

Normal Response: Difference scores should not exceed 10 to 15% regardless of the degree of hearing loss. However, variations in tape recorder speeds in the clinic might affect interpretation. Normative data should be obtained for the equipment to be used.

Abnormal Response: Discrimination of speeded speech is thought to be a function of primary auditory areas of the

language dominant hemisphere. In cases of temporal lobe dysfuncton, the difference scores tend to be larger on the side contralateral to the lesion. This test may be sensitive to posterior temporal lobe dysfunction and may not show increased differences with anterior temporal lobe problems (Dempsey 1978). There is a common curve for all 3 speeds normally difference if present are 10dB maximum (De Quiras 1964).

With an increase in speed, the percentage articulation may even decrease. In extreme cases, there may be a multiple peaked curve; and the curve may fluctuate constantly when the articuiation score is modified by an . increase in intensity. This is commonly observed in the mentally retarted patients (de Quiros 1964).

(a) <u>Attention and memory span</u>

The condition may affect the out come of accelerated speech tests and it may be advisible to make them the subject as separate study (de Quiros, 1964).

(b) <u>The patient's sensory response</u>

Presbycusis is more likely of central than of peripheral origin. There are several factors which may

indirectly cause a change in the sensory response level (with regard to hearing). One prominent factor in this respect is pain, which sooner or later makes it appearance in intracronial turners. Pain may cause elivation of the auditory threshold, a fact which may lead to errors in the interpretation of test results. In conductive losses, either normal results are obtained or the entire family of articulation curves is shifted as a set. In perceptive losses, the results may also be normal; but frequently the maximal articulation score at the speed of 350 wpm is lower than normal (De Quiros 1964).

Sticht and Gray (1969) studied the intelligibility of time compressed words as a function of age and hearing loss was studied. Speech intelligibility scores for time compressed PB words were determined for 28 young and old subjects having either normal or SN hearing losses. The discrimination of time compressed words was not affected differentially by the nature of the subjects hearing ability. How ever the time compression attenuated the prefermance of the aged more than the young, and this difference increased as the amount of compression was increased.

Aged individuals often show progressively poorer performance (by age) in the 60% compression condition, regardless of the degree of the hearing loss. This may indicate the degree to which central dysfunction overlies a peripheral loss influencing speech and language processing (Dempsyy, 1978).

The effects of time-compression on the intelligibility of CNC monosyllables was investigated by Kurdzriel et al., (1975) by presenting 6 conditions of a time compressed version of the NV test No.6, at 4 sensation levels, to 9 subjects with noise induced SN hearing impairments. Results indicated that intelligibility gradually decreased as the ratio of the time-compression increased, with a dramatic breakdown at the highest ratio of time compression. A typical roll-over phenomenon was also found. Results are related to dates on normal listeners.

(c) Cortical Lesion

The test is designed to make "message integration more difficult. Wrong conclusions may be reached in cases of cerebral or cerebellar lesions.

Temporal lobe tumors when growing rapidly and/or by invasion from elsewhere, cause the threshold of detectability to shift for varying degrees. In addition, there is usually aphasia and alterations of attention and memory span. If however, the tumor grows more slowly and does not invade tne temporal lobe, there may be no threshold shift at all. Temporal lesions of other origins may show almost normal test results. Threshold shifts of no more than 10 dB may be found; but maximum articulation scores may be seen shifted by approximately 40 dB. Taken as a whole, it appears that threshold alterations in the time-compressed speech are not an invariable sign of temporal lobe lesion (de Quiros, 1964).

"

Kurdziel (1973) did a study on performance by cortical lesion patients on 40% and 60% time-compressed speech material. The tape recordings of T-C (40% & 60%) monosyllables were administered to 7 patients with temporal lobe lesion and 3 hemispherectomy patients. Time-compression was accomplished with the fairbanks electromechanical apparatus which allowed temporal compression but did not introduce frequency distoration. The results revealed that with 60% T-C, all patients showed breakdown of speech

discrimination in the ear contralateral to the lesion. Breakdown was neither as frequent nor as dramatic with 40% time compressed materials.

Performance by cortical lesion patients on 40 and 60% time-compression was studied by Kurdziel et al., (1976). Tape recordings of time-compressed (40 and 60%) monosyllables were administered to 11 patients with diffuse unilateral temporal lobe lesion 4 hemisphere-ctomy patients, and 16 patients with discrete unilateral temporal lobe lesion. Time compression was accomplished with the Fairbanks electromechanical apparatus, which allowed temporal compression but did not introduce frequency distortion. The results revealed that with 60% time compression, all patients with diffuse unilateral cortical lesion showed breakdown of speech discrimination in the ear contralateral to the lesion. Patients with discrete unilateral cortical lesion generally did not demonstrate breakdown with the 60% time-compressed material.

(d) Results obtained with Aphasics

Pathological results may be obtained in a wide variety as conditions which go far beyond the domin

of aphasia. In addition to those signs and symptoms directly related to aphasia (such as auditay agnosia and aproctognosia), other cerebral, cerebellar, and proprioceptive disturbances may be mentioned which may cause a functional disability and thus lead to pathological results. Degenerative lesions, vascular lesions, and sometimes also very minor lesions may likewise affect message integration (Dequiros, 1964).

De Ruyter and Penn (1974) studied the effect of time altered speech on the auditory discrimination ability of Aphasics. The breakdown in auditory processing ability is observed frequently in the adult aphasic. Time-altered non-sense syllable, pairs were presented to 6 aphasic subjects. Findings indicated that the compressed and expanded stimuli did not improve accurate discriminatian scores for any of the subjects. Further more each subjects demonstrated that correct discrimination of nonsense syllable pairs was related positively to the number of different distinctive features involved, regardless of time condition.

Perception of rate altered sentential approximations by normal and Aphasic children was studied by

Rudnick and Berry in 1974. 25, fair word, first - and second - order senfential approximations were presented to 20 aphaic children and 18 normal children. The material was taped and altered to represent 5 speaking rates (140 normal); 75 and 105 (expanded); and 180 and 205 (compressed) wpm. Order of presentation was randomized. The major difference between the two groups of children was that the second-order material was perceived best by normal children regardless of rate, while the aphasic children showed this performance only at the normal rate.

Barry and Gerold (1975) studied the effects of time altered speech on the auditory comprehension of adult aphasics 10 adult aphasics were presented with an auditory comprehension task for yes/no questions. 60 questions were with regard to the rate of presentation (syllables/sec) and interphrase pause time. Results indicated little support for the clinical approach of 'talking slowly' and 'increasing time between meaningful units' to improve performance on auditory comprehension tasks for adult aphasics.

Results obtained with reading disabilities

Freeman and Beasley in 1976 did a study on preferance of Reading Impaired and normal reading children on time-compressed monosyllables and sentential stimuli. This study investigated the performance of group of normal reading and reading-impaired children on time. Compressed 3 and 5 word sentential approximations to full grammaticality and the word intelligibility by picture identification (WIPI) test presented with and without pictures. The results suggested that the reading -impaired children could be differentiated from the normal readers by scores on these measures and by the different types of errors made by the two groups.

Children with reading disabilities and auditory processing disorders may show poor performance, especially in the sentence tests. These results would be consistent with a rate specific disability (Dempsey 1978).

Results of extratemporal lesion

In some of these cases, small almost insignificant shifts of the threshold of detectability may be seen.

More frequently, however, there are shifts in the threshold of intelligibility and of the point at which articulation is attained (De Quiros, 1964).

Results of Auditory processing disorder

. Manning et al, in 1977 administered a time-compressed version of PB-K 50 speech discrimination measure to 20 children diagnosed as displaying auditory perceptual disorders. Results indicated that these children performed equally well at both 0 and 30% time compression. Performance decreased significantly at 60% time-compression. Comparison of the data indicated that performance of the two groups of children was similar at the 30% time-compression condition but that children with auditory perceptual disorders performed poorer at both 0 and 60% time-compression.

Time-campressed, or speeded, speech inevitably becomes unintelligible to normal listeners when a high compression ratio is reached, but listeners having cortical lesions of the temporal lobe show markedly poorer under-standing at such speeded speech in the ear contralateral to the lesion. The point at which this breakdown occurs between normal-hearers and temporal lobe patients depends

upon the materials used; words are more strongly affected than sentences. Elderly persons also have difficulty on this task (Snow et al. 1977; Berlin 1976).

Results obtained with brain stem pathology

The results in basilar-artery insufficiency are very vague; there might be a shift of the threshold of detectability on the side of the predominant symptoms.

Cerebellar lesions, even when compression the brain stem, apparently do not affect the test results as far as the threshold of detectability is concerned. The maximal articulation score may be found altered in one or both ears.

Brain stem lesions, as a rule, do not affect the threshold of detectQbility. However, there may be shifts of the point of, or reduction in, the maximal articulation score.

Results obtained in other disturbances

In central vestibular disturbances the results are usually non pathological.

In retro-cochlear lesions if there is no

increase in endocrinal pressure the test results are non-pathological.

In spiral cord lesion the results are normal.

In localization of the lesion time-compressed speech test provides information which when correlated with other findings may aid in pinpointing the sites of brain lesions, especially those within the temporal lobe.

In patients with increased endo-cramal pressure of sudden onset, the tests apparently do not produce a shift of the threshold of detectability. However, the maximal articulation score, as a rule, is severely affected (De Quiros, 1964).

Synthetic sentence identificate test development

The synthextic sentence identification test was first described by Charles Speaks and James Jerger in 1965.

Classically the subject either repeats aloud what he hears, or chooses the answer from among some number of alternative choice unique to the signal. In contrast here task is to identify which of the several alternative message was presented.

The advantages of this procedure over classical technique were (i) The message set is always closed and of controlled size, (ii) testing procedures can be easily automated, permitting acquisition of considerable data with minimal opportunity for experimenter error, (iii) The effect of learning or practice for a message set can be determined with relative ease.

The authors say that the nature of the sentences to be used presents several problems. In a "red)!' sentence, "meaning" may be conveyed by only one or two key words. Also, construction of reasonably equivalent message sets containing 'real' sentences is exceedingly difficult due to the variable factors of vocabulary, word familiarity, word length, sentence length and syntactical structure. What synthetic sentences offer, therefore, are verbal materials that have minimum contexual clues and minimum redundancy when compared to actual English sentences.

Twentyfour message sets of 10 sentences each were constructed, including nine first-order sets, nine second-order sets, and six third-order sets an3 a series of experiments were designed to study several aspects of SSI testing.

They did 3 experiments. The purpose of the first experiment was to determine the relation among orders of approximations and the nature of learning over successive trials 6 normal hearing subjects listened to the list. In order to render the material sufficiently difficult for normals, the tape output was routed through a low-pass filter. Results revealed a small practice effect between tne first and third trial of filtered synthetic sentences.

The second experiment was performed to determine whether the effects of learning or practice would be diminished if the nature of the practice session were changed The results indicated that the pattern of correct responses is quite stable over the last 7 trials. The more carefully. controlled practice session used in this experiment minimized changes in performance due to learning over successive trials.

The purpose of third experiment was to assess the relation among the orders of approximation to 'real' sentences under a condition of periodic interruption. The results showed that the same systematic ordering as a function of order of approximation was apparent. Performance improved systematically as the amount of information is decreased even when 75% of message set is deleted. The difference for the penodic interruption condition were smaller than those obtained with the low-pass filter condition.

Speaks et al,,(1966) studied the P-1 characteristics of synthetic sentences. The recorded material was presented normally via earphones at 40 dB SPL. The study suggested (1) the P.I functions are characteristically sigmoidal and quite steep. (2) The effect of low-pass filtering (cut off frequency 500 Hz) was to make the identification task uniformly more difficult with no appreciable effect on the shape of the function (3) Performance was related to contexual constraints of the message sets (4) The strategies employed by listeners were complex and apparently not restricted to single word recognition.

The first clinical application of the SSI test was by Speaks et al, (1968). The authors recognized that the identification task was too easy, if the sentences were presented in quiet, since no matter how poor a patient's discrimination score for monosyllables, the SSI score reached a maximum of 100% at high intensities. To make the task more difficult, an ipsilateral competing speech message of continuous discourse was added to the sentences. Intensity functions for monosyllables and synthetic sentence. Identification at 0 dB MCR were reported on several patients with hearing impairment.

Speaks,.O. (1967) studied the P.I characteristics of selected verbal materials. P.I functions for synthetic sentence message sets were compared with analogus functions for spondiac words and for PB monosyllabic words. 4 trained listeners with normal hearing were tested The function for sentences was slightly steeper than the function for spondiac words and markedly steeper than the function for PB words.

The function relating performance to intensity for synthetic sentence message sets presented in quiet is exceedingly steep. Two experiments were conducted by Speaks, Karmen and Bunitez (1967) to determine the degree to which the P-I functions could be flattened by adding a competing message at selected MCRs. Data were obtained from 5 trained listeners in a criterion controlled experiment and 23 naive listeners in a criterion-free experiment. Addition of the competing message flattened the P-I function substantially. The degree of flattening was related to the presentation level of the messages.

The effects of frequency filtering on intelligibility of Synthetic sentences were studied by Speaks (1967) on 3 normal hearing listeners. P-I functions were defined for several low pass and high-pass frequency bands. Intelligibility of Synthetic Sentences was found to be quite dependent upon low-frequency energy. The important frequency for identification of the material was approximately 725 Hz.

Webb & Greenberg (880) did a study on the evaluation of a new tape recording of the SSI test. The purpose was to collect normative data on a commertially available tape recording of the SSI-ICM. The results provide data on the Auditec SSI-ICM tape that can be used as a normal reference in clinical assessment of speech discrimination ability and site of lesion.

Nagaraja (1973) developed SSI test in Kannada. He constructed Synthetic sentences in Kannada using most commonly used words in Kannada language. This was presented to 30 normal hearing subjects to find out the presentation level and MCR level at which performance is maximum. He found that (l) performance varied directly with the level of presentation and inversely with MCR. Conductive loss cases didnot show deviation from normalcy, The SN loss group, mixed hearing loss group and high frequency hearing loss group showed significant difference.

Hg aid evaluation

Jerger (1970), recorded SSI test material each of 21 hearing aids. This was played to 5 normal listeners. SSI results were then correlated with various

electro-acoustic measures of hearing aid performance.'

The adoptation of SSI to both the administration and evaluation of auditory training procedures was studied in 5 hearing impaired subjects. Results indicated that successfully auditory training procedures, based on SSI, could be devised, and that improvement generalized to other speech tasks.

The Synthetic sentence Identificationand the No 6 were compared in a hearing aid evaluation by orchik and Roddy in 1980 using normal-hearing listeners and subjects with SN hearing loss. The results obtained with the No 6 indicated greater aided benefit as well as greater residual deficit than the SSI for these hearing-impaired subjects.

Cochlear disorder

There is fairly systematic relation between audiometric slope and discrepancy between PB and SSI. When the contour is flat, the two functions agree. But as the slope becomes more secere, PB declines more rapidly than SSI. The discrepancy is greatest in patients with

good hearing at low frequency, but with severe drop in the high frequencies (Jerger, speaks and tramell, 1968).

Results indicate that SSI performance scores obtained in the presence of a competing speech message at a suitable MCR are interchangeable with more traditional methods of speech intelligibility based on single word repetion. Patients with sharply sloping audiometric contours perform better on SSI material than PB materials. There is close correspondance between PI function of SSI and PB procedure so long as the audiometric configuration is relatively flat. As the pattern of loss slopes downward as a function of frequency however, the area under the PB function becomes smaller than the area under the SSI function. The discrepancy grows larger as the slope of the loss becomes steeper. Comparison of performance on SSI materials between a patient with cochlear disorder and a patient with cochlear and temporal lobe disorder shows that the cochlear disorder does not affect performance, when the sentence materials are degraded, in the same degree that temporal lobe disorder disrupts performance (Jerger J. 1970).

8th Nerve disorder pattern

PB and SSI procedure showed similar results although SSI showed a slightly lower maximum and a roll over at high, speed levels, (jerger and Speaks (1968)

PB maximum tends to be below SSI maximum in sloping high-frequency contours, and SSI tends to be below PB in rising low frequency contours, but the effects are widly exaggerated, with differences of 50% to 60% in the two functions, when the audiometric contour is only gently sloping. At other times both functions are so depressed that little difference appears in spite of a sharply sloping audiometric contour. The distinguishing feature of 8th nerve disorders, is a characteristic modification in the shape of one or both PI function. At high speech intensity levels, decrease in performance with increasing level. This'rollover' phenomenon is the signature of the 8th nerve site, although it may also appear in some cases with more central sites (Jerger and Hayes, 1977).

For 8th nerve patients, the SSI procedures characterized by poor performance on both ICM and CCM. All defects were confined to ipsilateral ear only (Jerger and Jerger, 1975).

Lesions of Brain stem and cortex

In the case of central auditory disorder at least 4 potential sources of errors are found Jerger and Jerger (1975). The possibility that the patients may perform poorly on difficult auditory tests due entirely to physical molaise rather than a central auditory problem (2) The possibility that patients with any disorder of the CNS may perform poorly on central auditory tests even though there is no direct involvement of central auditory pathways per se. (3) The possibility that the presence of a language disorder in some patients with temporal lobe site may compromise the eliognastic value of degraded speech audiometry (4) the possibility tht auditory test results may not be site specific.

Jerger, Speaks and Tramell (1968), report that speech scores were lower on contralateral ear. PB and SSI function lead to the same conclusions SSI area

was smaller than the PB area. Both functions showed rollover phenomenon at high speech levels.

Jerger.J (1970) tested 3 patients one with unilateral brain stem pathology, 2 with unilateral lesion affecting the primary auditory projection area in the temporal lobe. Loe pass filtering had little effect on the patient with temporal lobe disorder but a marked effect on the patient with brain stem disorder. Brain-stem disorder performance was poor on both ears, the greatest effect was observed on the contralateral ear. Temporal interruption of Synthetic Sentences had a marked effect on the brain stem patient but only a slight effect on the temporal lobe patient.

CCM condition is extremely sensitive to temporal lobe lesion (Millman and Oslen 1973). They illustrated a patient with left temporal lobe lesion who performed normally when the sentence goes to the left ear and competition to the right ear. However, he showed a performance defint when the sentence was presented to the right ear and the competing message to the left ear

patients with brainstem disorder ordinarily had little difficulty with the CCM condition.

Jerger and Jerger (1975) compared auditory test results in 28 patients with extra-axial, 11 patients with intra-axial, and 6 patients with combined extra axial and intra-axial brain stem disorders. Two patients had poor SSI ICM scores on the ear ipsilateral to the lesion only performance on the SSI-CCM was usually good. The performance deficit for ICM was considerably more dramatic than the relatively slight CCM deficit.

Jerger and Jerger (1975) tested patients with brain-stem and temporal lobe lesion. For Brain stem patients, the SSI procedure showed poor performance for ICM and relatively good performance for CCM. There may be ICM deficits on both ears, instead of the contralateral ear only and/or a relatively mild CCM deficit on the contralateral ear only, instead of normal performance on both ears. For temporal lobe patients, the SSI procedure yields poor performance on both ICM and CCM. The ICM

deficits are observed.on both ears and the CCM deficit is observed on the contralateral ear only.

Winkelaar and Leavis (1977) discusses 3 audiological tests (competing sentences, Rapidly altering speech, staggered spondiac words). Results suggested that the tests were of value in identifying and/or corroborating central lesions, and in providing a more complete explanation of patient communicative difficulties.

Jerger and Hayes (1977) gave central patterns. In patients with CAD the SSI function typically falls well below the PB function. The large SSI - PB discrepancy is typically present in ears with quite normal sensitivity. The discrepancy appears on the ear contralateral to the affected side of the brain.

Ha11 and Jerger in 1978 assessed 10 stutterers and 10 nonstufferers with a battery of tests. As a group, the stutterers presented evidence of a central auditory deficiency. The pattern of test results suggested a disorder at the brainstem level.

In 1978 Toscher and Rupp compared the performance of 14 stutterers and 14 normals on Synthetic Sentence Identification. The performance of stuttering group was significantly poorer than that of non-stutterers on the ICM subtest. The results suggest a neurological dysfunction within central auditory apparatus.

SSI - ICM test at a - 20 dB MCR was used to investigate central auditory function of fluent and disfluent normal speaker by Wynne and Boefimler (1982). It was suggested that a central auditory variable may be one of the factor contributing to the production of disfluent speech at the level of syllable production.

Aging effect

Unlike younger people with CAD, the elderly, typically show both P-T sensitivity loss and decreased PB scores. The SSI function usually falls below the PB function to a greater of lesser extent in the elderly population, a fact which may be attributed to central

aging effect. The central effect begins, on the average at about the age of 60 years and increases substantially there after (Jerger and Heys, 1977).

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CHAPTER - III

METHODOLOGY

Subjects: Thirty seven normal hearing adults, in the age range 17 years to 26 years with a mean age of 19.78 years served as subjects for this study. Of them 19 were females and 18 were males. Subjects were AIISH students Each subject was required to:

1. have normal a-c thresholds (ANSI 1969! at frequencies 250, 500, 1000, 2000, 4000 and 8000 HZ in both the ears.

2. have speech reception threshold (SRT) within 25 dB HTL SRT was obtained using the procedure described by Tillman and olsen (1973). The SRT range was 5 to 25 dB HTL (ANSI, 1969).

Material: The experimental speech material was time-compressed. Ten Synthetic sentences given by Speaks and Jerger (1965) were used. The list is given in table 1.

Table - 1.

sl. No.	**Sentences**
1.	Small boat with a picture has become
2.	Built the government with the force almost
3.	Go change your car colour is red
4.	Forward march said the boy had a
5.	March around with out a care in your
6.	That neighbour who said business is better
7.	Battle cry and be better than ever
8.	Down by the time is real enough
9.	Agree with him only to find out
10.	Women view men with green paper should.

These 10 sentences were constructed as third-order approximations to real sentences. Speech noise was used for insilateral masking.

Instrumentation

A two channel stereo cassette tape deck (Cosmic Co 88xD) with a review and cue system was used for recording. Philips omni directional microphone (LBD 8220) was used with this stereo cassette tape deck for the recording purpose.

Philips portable tape recorder (No.033409) was used to administer the test.

A two channel diagnostic audiometer (Beltone 200 C) was used. This was connected to a portable philips tape recorder. The stimulus was delivered to the ear through the Transducer TDH 49 with supra aural ear cushion (MX-41/AR). The output SPL of earphone was checked using a recorded 1000 Hz tone.

Variable speech controller was used to compress the sentences. It is a tape recorder with a provision to control the rate without altering the frequency character. The rate can either be increased

or decreased with the help of a knob, ie., we can either compress or expand the material. Rate one indicates no compression and 1.5, 2 and 2.5 indicates successive increase in compression rate.

Recording procedure

The sentences were read by a male speaker (a native speaker of Telagu) with South Indian dialect. Before the actual recording the speaker practiced to monitor the sentence level using a VU meter. The sentences were read at conversational rate.

First recording of the 4 randomized lists were done in a sound treated room?' Recording level was monitored using a VU meter; constant distance between the speaker and the microphone was maintained. This recorded material was time-compressed using variable speech controller. The maternal was compressed to the rates of 1, 1.5, 2 and 2.5. The recording level was monitored with the help of line input and a VU meter.

An interstimulus interval of 30 seconds was maintained between each stimulus for the subject to respond.

The entire recording was done in a single session.

Pilot study: 5 subjects (2 males and 3 females) with the age range of 19 to 26 years served as subjects. The stimulus was presented at 40 dB above SRT. Each subject was presented with the stimulus at all the four compressional levels randomly to the right ear. It was found that the task was too easy when presented in quiet (since it was presented at 40 dB above SRT). Identification scores reacted a maximum of 100%. To make the task more difficult, on ipsilateral competing message (speech noise) was added to the sentences.

Procedure

The first step was to establish the presence of normal or near-normal pure-tone sensitivity in both ears. Puretone audiometry was done to all the subjects. Each subject was tested individually in a sound treated room with the experimenter seated in an adjacent control

room. Speech reception threshold was determined using the procedure described by Tillman and Olsen (1973).

Speech noise was given ipsilaterally. The noise level which was just insufficient to mask the sentences which were presented at 40 dB above SRT was determined. To find the noise level which was just insufficient to mask the sentences one sentence without compression was used with all the subjects. The noise was introduced ipsilaterally and the subjects made the judgement as the noise level was increased. Thus the level of noise which was just insufficient to mask the sentence presented at 40 dB above SRT was determined for each subject.

The stimulus material was presented at 40 dB above SRT. The four lists with compression rates 1, 1.5, 2 and 2.5 were presented randomly to all 32 subjects. Right ear was the test ear for 30 subjects and left ear was the test ear for 2 subjects. The test was administered to the left ear in two subjects as they wanted the testing to be done in left ear only.

The whole testing was completed in a single session which lasted for 45 minutes.

Instructions

(a) For the establishment of a-c thresholds:

When you hear the tone, raise your index finger, even when the tone is very soft. Hold it up as long as you hear it and when you no longer hear it, bring your finger down. Raise the right hand index finger when you hear tne tone in your right ear and raise the left hand finger when you hear the tone in your left ear.

(b) For the establishment of SRT

I am going to say some words to you, my voice will get softer and softer. Just repeat the words after me, if you do not hear the word well, try to guess it.

(c) For Time-compressed speech

You will hear a number of sentences along with noise in your ear (either right or left). Some are

fast and some are slow. Identify the sentences in the list given to you and tell me the sentence number.

Response mode and scoring

Subjects were given the standard list of sentences. They were asked to identify the sentences heard, by telling the sentence number.

The subjects response was compared with the list presented and the correct response was given 10% score.

At each time compression level total percentage was calculated. This was done to each subject.

Data analysis

Mean percentage score was calculated at each compression level. The effect of time-compression on percentage scores was calculated using appropriate statistical methods.

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CHAPTER - IV

RESULTS

The results of this study provide data on the ability of normal young adults to identify the temporally altered Synthetic Sentential stimuli.

Four lists were designed specifically for this study. Each correct response was given a weightage of 10%. The subjects score on each list was obtained. The mean percentage score was computed for each list. The other statistical measures utilized in the study are Standard Deviation (SD) and Range.

Standard deviations and ranges across the list at each time-compressed levels are summarized in table 2.

T-C rates	1	1.5	2	2.5
Mean	95.31%	81.25%	64.06%	29.69%
S.D.	7.9	19.16	27.03	23.25
Range	30	70	100	100

The results show that the subject mean percentage scores at compression rates of 1 (without compression), 1.5, 2 and 2.5 were 95.31, 81.25, 64.06 and 29.69% respectively. The sandard deviations reflects limited dispersion at rate one, and wide dispersion at other 3 rates.

To determine the significance of means at different compressonal levels the percentage scores were subjected to an analysis of variance. Significant mean difference ($P < 0.0001$) supported the inverse relationship between sentence identification and rate of time-compression That is, the percentage scores decreased as the compression rate increased.

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CHAPTER - V

DISCUSSION

The results show that the percentage of performance decreases as the time-compression rate is increased. This is in accordance with the earlier studies (Fairbanks et al., 1957; Beasley, Forman and Rintelmann 1972; Beasley, Schwimmer, Rintelmann 1972; Maki, 1974; Nikam et al., 1976; Sood, 1981).

The results suggest that normal hearing individuals perform better at rates 1 (with-out compression) and 1.5, and the performance decreases as the rate of compression is increased further. The performance at the rate 2 is comparatively better that at the rate 2.5 ie., the performance gradually decreases as the rate of compression is increased. As the test seems to be difficult enough for normal hearing subjects, it would probably be diagnostically useful with individuals with central auditory dysfunction. Individuals with central auditory dysfunction may perform poorly because the intrinsic and extrinsic redundancy is reduced and thus challenging the central auditory dysfunction. The difficult conditions of the SSI - ICM and time-compression

are expected to be sensitive to reveal the central auditory lesion.

The data suggest that time-compressed SSI test may be useful as a diagnostic tool in identifying central auditory dysfunction in stutterers, learning disabled children, aphasics, etc.

Time-compressed SSI test can be used to diagnose central auditory dysfunction in stutterers. It may show central auditory dysfunction in stutterers. Toscher and Rupp (1978), Hall and Jerger (1978) have found that their results do not support the interpretation that stutterers in general differ from nonstufferers. On the contrary, Wynne and Boehmter (1982) suggest that there may be a central auditory deficit in speech processing in stutterers. The SSI - ICM test is sensitive to find out the brain stem disorders, time-compressed speech test is sensitive to find out the cortical lesion. SO the procedure used in this study can be used to find out the possibility of central auditory dysfunction in stutterers.

Brain stem lesions are frequently masquerade by cochlear and nerve 8th abnormalities, while brain pathology may be noted in patients with a wide variety of communication disorders (Kawtz, 1978). The present test may be administered to aphasics to find out the feasibility of the test for locating the lesion. Intact language centers are necessary for correct response. Bocca and Calcaro (1963) suggest that all speech tests depend on the correct activation of language centers for a response to the stimulus. The activation of the language centers is a guarantee that the message has arrived, as suln at the cortex, and thus testing all the stages of integration as far as the higher level. So the time-compressed SSI test can be used with aphasics (predominantly expressive) by making the subject to identify the stimuli.

The present test may be a useful diagnostic tool in identifying auditory perceptual problems in children. Children with auditory processing disorders and reading disabilities may be expected to show poor performance when compared to the normal.

In summary, the time-compressed SSI test can be tried to detect cortical lesion and brain stem lesion. One single test in isolation may not have much significance in the diagnosis, but the combination of many procedures may be very illuminating in a given case.

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CHAPTER - VI

SYMMARY AND CONCLUSION

The present study aimed at Development and Standardization of Time-compressed SSI test. The SSI sentences given by Speaks and Jerger (1965) were recorded in a sound treated room and these recorded sentences were time compressed using variable speech controller to the rates 1, 1.5, 2 and 2.5.

Thirty-seven normal hearing adults, in the age range 17 years to 26 years with a mean of 19.78 years served as subjects. Each subject was required to (1) have normal a-c threshold (ANSI, 1969) at frequencies from 250 to 8000 Hz at octave intervals (2) have Speech Reception Threshold within 25 dB HTL.

After establishing the presence of normal or near-normal pure tone sensitivity in both ears. Speech Reception Threshold was determined using the procedure described by Tillman and Olsen (1973). Speech noise was given ipsilaterally and the noise level wnich was just

insufficient to mask the sentences presented at 40 dB above SRT was determined. Four lists with compression rates 1, 1.5, 2 and 2.5 were presented randomly to all 32 subjects.

Mean percentage score was calculated at each compression level. The effect of time-compression on percentage scores was calculated using one way analysis of vanance.

Conclusions

1. Dispersion was limited at rate one, and wider at other 3 time-compression rates.

2. The percentage scores decreased as the time-compression rate increased.

3. There was significant difference in the mean percentage scores obtained at all the compression rates which were used in the present study.

Recommendations

1. The present study has clearly revealed the as compression rate increases, the performance of normal subjects deteriorates. Hence, the time-compressed SSI test may be expected to be a useful clinical tool for identifying temporal lobe lesion cases. Therefore, it would be worthwhile to administer this test on clinical population to establish its clinical usefulness.

2. It is recommended that this test may be administered to stuttering cases to find out whether their performance differs significantly from that of normal subjects.

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