Perception of Time-Compressed C N C Monosyllables by Non-native Speakers of English

Sunil Kumar Sood

A Dissertation Submitted in Part Fulfilment
for the Degree of Master of Science
(Speech and Hearing)
University of Mysore
1981

TO MY BELOVED PARENTS

C E R T I F I C A T E

This is to certify that the dissertation entitled " Perception of Time-Compressed CNC Monosyllables by Non-Native speakers of English," is the bona-fide work in part fulfillment for the Degree of Master of Science in Speech and Hearing, carrying 100 marks, of the student with Registration No.13.

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

C E R T I F I C A T E

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

(GUIDE)

Dr.(Miss) S. Nikam
Professor and Head of Dept. of Audiology
All India Institute of Speech & Hearing,
Mysore - 570 006.

D E C L A R A T I 0 N

This dissertation is the result of my own study undertaken under the guidance of Dr. S.Nikam, Professor and Head, Dept., of Audiology, All India Institute of Speech and Hearing, and has not been submitted earlier at any other University for any other Diploma or Degree.

Mysore
May 1981 Registration No. 13

ACKNOWLEDGEMENTS

The investigator is highly indebted to Dr.(Miss) S.Nikam, Professor and Head, Dept., of Audiology, All India Institute of Speech and Hearing, for her valuable guidance, constant concern and resourceful help.

He is grateful to Dr.N.Rathna, Director, All India Institute of Speech and Hearing, for having provided all the facilities for the conduct of this experiment; Mr.S.S.Murthy, Lecturer in Electronics, for his help in instrumentation.

He extends his appreciation to Miss. Malini, Mr. Ashok, Miss. Maharani, and Miss. Rashmi for their help during various stages of this study.

The subjects of this study were students who showed keen interest and cooperation. Their help is acknowledged gratefully.

Thanks to Mr. Shankar for neat and fast typing.

TABLE OF CONTENTS

-000-

CHAPTER - I

INTRODUCTION

A battery of tests yields response patterns that are uniquely associated with damage to various sites of the peripheral auditory system. However, these conventional auditory tests elicit essentially normal response patterns from individuals with disorders of the higher auditory pathways (willefford 1969).

Apparently, these conventional procedures, because of their lack of structure and sensitivity necessary for delecting central auditory lesions (Beasley et al., 1972), and because of their simplicity and excessive redundency, fail to be of any value in diagnosing central auditory disorder (jerger, 1973). various means of reducing this redundancy, and enhancing their sensitivity to central auditory lisions have been developed that include frequency altered speech, dichotic listening tasks, and temparal

distortion of speech. Because of the complexity and neural redundancy of the central nervous system, measures of central auditory function require stimuli of a complex nature.

One such procedure is to "compress" the speech signal temporally, thereby reducing the comm-unication time. The time - compresion reduces the extrinsic temporal redundancy of the normal speech signal thence increasing the difficulty of the proce-ssing task by the internally redundant nervous system. These implication have been based upon the "Subtlety" and "bottleneck" principles espoused by Jerger (1960).

The early development of an electro-mechanical time - compression/expansion apparatus by Fairbanks (Fairbanks, Everitt, and Jaeger, 1954) and more recently of the Laxicon varispeech I (Lee, 1971)

has triggered a spate of investigations using time compressed word lists (luterman et al., 1966; stricht and Gray, 1969 ; Beasley et al., 1972 ; Maki et al., 1976 ; Manning et al., 1977 ; Kurdziel and Noffsinger, 1973 ; Beasley et al., 1980) and sentantial stimuli (Beasley and Shriner, 1973 ; Rudnick and Barry , 1974, Freeman and Beasley, 1976 ; Beasley et al., 1980).

Data on intelligibility time - compressed speech have been reported for groups of normal children (Maki, 1974 Manning et al., 1975 ; Orchik et al., 1976), and groups of children having various speech and hearing disorders such as hearingloss of cochlear origin (Sticht and Gray, 1969; Maki et al., 1976), aphasics (Rudnick and Barry, 1974), articulatory defective (Qrchik and Oelschlaeger, 1974), and reading impaired children (Freeman and Beasley, 1976).

Groups of Aged - persons and persons with known or suspected central auditory problems have also

been studied (Lutermann et al., 1966 ; De Ruyter and Perrin, 1974 ; Kenkle and Bess,1974 ; Barry and Canter, 1975 ; Korabic, Freeman, and Church, 1976).

A number of investigations have been done involving various tasks of comprehension (Fairbanks et al., 1957, a and b ; Wood, 1965 ? Freeman and Church, 1977), and intelligibility (Schwimmer et al., 1971 ; Bratt, 1976; Schwartz and mikas, 1977) of time compressed stimuli.

The use of time compression as procedure in central auditory test battery has grown out of the need to detect subtle neurological lesions which may go unnoticed by the use of conventional pure-tone and standard word discrimination measures.

Investigations done using time compressed speech discrimination tasks on non-native speakers have been few. These studies observe a definite effect of linguistic factors on the performance of

non-native speakers. Language relatedness,and familiarity with and exposure to the language have been shown to influence results.

A study done by Nikam, Beasley, and Rintelmann (1976) on performance of non—native speakers on time compressed speech discrimination task shows that Indo-Dravidian and Spanish speakers performed poorly on English test when compared to Native English speakers. Moreover, the performance of Indo-Dravidian speakers was poorer overall than the spanish speakers. The question arises whether this poorer performance of Indo-Dravidian subjects was due to the foreign accent since they were familiar with the accent and had prior exposure, even though acquired English in India. It is not known whether foreign accent had any significant effect on the performance ; further, the time compression may have interacted with influence of foreign accent.

As Lane (1963) pointed out, by studying filtered and masked listening tasks, that the foreign accent does effect the out ceme of results in difficult listening tasks by interacting with each other.

On the same lines, it may be expected that Indians, who were not exposed to foreign accent of the speech stimuli, will perform poorly when compared to Indo-Dravidian subjects in Nikam et al. (1976) study.

The present investigation was undertaken to study the performance of young adults on a time compressed speech discrimination measure. The test stimuli used were same as those utilized by Nikam et al. (l976). This was done to study the influence of foreign accent on speech discrimination and to see if the same measure could be adequately applied to the Indian set-up—prior to using these stimuli on pathological groups of subjects.

The four lists of Form B of the Northwestern

University Auditory test No. 6 (NU-6) have been standardized elsewhere for young adults (Beasley et al., 1972 ; Schwimmer and Kintlemann, 1972; Beasley et al., 1980). and young children (Manning et al., 1975 Beasley, Maki, and Orchik., 1976).

Need for the presence study

Standardized tests of central auditory dysfunction are not available in Indian set-up, other than the performance-Intensity function for the Phonetically balance words (PI - PB). This procedure often fails to adequately " tax " the central auditory system and the results are often influenced by presence of a concomittant peripheral auditory problem (Beasley et al.,1972)

Therefore a test is required that may be used in Indian set-up and that will effectively delineate the central auditory problems.

Description of test Material

The Northwestern University Auditory test No. 6 (NU - 6) consists of four forms,each of them having four lists. This is a modification of earlier NU - 4 test which included two lists of phonetically balanced words. The test was modified to obtain alternative forms for clinical and research purposes. Each list consists of 50 words randomly selected under each list.

Vocabulary Test: The vocabulary test, devised by lewis (1968), was utilized as one of the procedures for subject selection. The test consists of sixty items most of which are presented in a phrase form. The closest meaning to the word is to be chosen out of five choices presented in the test. The list covers a wide range of ward vocabulary.

A test of English Ability: Developed at the central Institute of English as Foreign language, is meant to evaluate language competancy in general. It

comprises of six sections each of which tests usage of prepositions, pronouns and articles and grammer and comprehersion. This test was also utilized in selection of subjects to ascertain language abilities.

Though in the present study Indo-Dravidian subjects were used, the term "Indi-Dravidian" hereforth refers to the subjects of only other studies in discussion (e.g., Nikam et al., 1976) to which the present study is compared.

Summary and statement of the problem:

Briefly, the purpose of this study was two fold. One, to study the performance of young adults an the time compressed speech discrimination task, and, second to study the influence of foreign accent on the performance-in order tosee if the test can be used in the Indian set-up.

Answers to following questions were saught in this study:

1. Is there an effect of foreign accent on speech discrimination of time-compressed task ? and if yes, what ?
2. Is there a significant improvement in discrimination scores with increasing sensation level?
3. What effect does time-compression have on listeners' performance
4. Is there an interaction between time-compression level and sensation level ?
5. Can the test be used in Indian set-up.

-oOo-

CHAPTER 2

REVIEW OF LITERATURE

The simplicity and excessive redundancy of traditional measures of audition, such as puretones, words and simple sentences have proved to be of limited value in the diagnosis of central auditory disorders (Jerger, 1973). Because of the complexity and neural redundancy of the central nervous system, measures of central auditory dysfunction require stimuli of a complex nature. Several investigations have employed temporally distorted speech signals, thereby reducing the temporal and spectral redundancy (Calearo and Lazzarone, 1957) and consequently 'taxing' the central auditory system. One such proce dure is to 'compress' the signal temporally, thus reducing the communication time. The time compression reduces the external temparal redundancy of the normal speech signal thence increasing the difficulty of the processing task by the internally redundant

central nervous system. These implications have been based upon the "subtlety" and "Bottleneck" principles by Jerger (1960).

One of the earliest experimental investigations of time altered speech was done by Fairbanks, Guttman, and Miron (1957 a,b). They reported on the relation-ship between comprehension of the factual details of spoken messages and the rate at which they were heard. Time - compression levels of 0, 30, 50, 60, 70, and 100% were obtained using Fairbanks'electromechanical compressor. Results indicated that time-compression affects the factual listening comprehension significantly.

In 1956, Bocca reported an audiometric accelerated speech test using both words and sentences. He believed that the test provided a measure of eitheir (a) reaction time (i.e., the functional time of the verbal image), (b) the speed of the transmission across cortical synapses, or (c) transmission speed along the auditory pathways. Bocca found that normal subjects

required an increase in presentation level to achieve an articulation score of 100%. Similar results were obtained by Bocca and Calearo (1956) and Calearo and Lazzarone (1957)

The fundamental work on time-compression appears to be a paper by calearo and Lazzaroni (1957) who studied elderly individuals (70-80 years), and patients with temporal and extra-temporal lobe tumours. Their results indicated that the old age group was more affected than patients with intracranial tumours. This might he the result of gross neural changes occurring throughout the auditory system-central and peripheral.

de Quiros (1964) carried out an exensive study on accelerated speech audiometry in Spanish. Accelerated speech tests were given to (1) 20 normal hearing persons, (2) 5 conductive loss patients, (3) 10 cochlear lesion persons, (4) 7 patients with presbycusis, and (5) 34

selected neurological patients (6 with retrocochlear lesions and 28 with central lesions).

Sentences with abstract and concrete meanings were used for testing adults and children respectively. The speeds used were 140 words per minute (w.pm.), 250 w.p.m., and 350 w.p.m.

de Quiros found, as a rule, that if the speed of presentation was increased from 140 w.p.m. to 250 w.p.m. (or, from 250 w.p.m. to 350 w.p.m.), an increase of 10 dB in the presentation level was required to preserve the subjects level of performance. This was considered to be normal.

The findings in various classes of cases studied were ambiguous and complex. Moreover, the procedures employed by calearo and Lazzaroni (195T) and de Quiros (1964) were not well described.

These and earlier studies by Garvey (1953) an by Klumpp & webster (1961 ; cited by Boulke and

Sticht, 1969) which used 'Faster-replay ' and 'Chop-splice' of recorded material to accelerate speech, failed to evoke any interest among researchers.

The chop-splice procedure involves chopping of the recorded signal tapes manually into segments and then splicing back some of the pieces, cutting others off. This method permitted the experimenter to very temporal nature of signal without carring undue dislortion of the frequency charactertictics. However, although the chop-splicing has been used to systematically vary the temporal length of samples it has proved to the cumbersome and inefficient (Beasley and Freeman, 1977)

Subsequently, the time-and frequency-altered speech has been studied using Fairbanks' electro-mechanical time-compression expansion device.

The device consists of a modified tape recorder

which records randomly selected signals obtained from another tape recording on a tape on a continous basis thus compressing the signal. The degree of time - compression is adjusted by varying the rate of random selection of signals to the recorded. The sampling of recorded original signal could occur anywhere within or between any linguistic segment, and in this sense, the portion selected (or discarded) was 'random.'

More recently, Lee (1972) developed an electronic time-compresser/expander. The device is known as 'varispeech I.' It is an inexpensive and portable device which employes a small tape recorder and a minicomputer and works on the principle of the Fairbanks' compressor. For practical purposes, the Lee (1972) device " is the current state of the art"

The most sophisticated methods for temporally modifying speech signals involve the use of digital com-

puters and speech synthesizers. These methods however, are currently in developmental stage end are extremely expansive compared to other techniques (Beasley and make, 1976).

Current interest in the clinical application of time compressed speech dates back to a study by Luterman, Welsh, and Melrose (1966). The responses of 18 Spanish -American war veterans to compressed and expanded PB word lists were compared to with the responses of two control groups composed of young hard of hearing subjects and young normal hearing subjects. The responses were obtained at two levels of compression and expansion, 10 and 20% immediately after sticht and Gray (1969) evaluated intelligibility of time compressed CID W-22 words for 28 young and 28 old sensorineural and normal hearing subjects. This investigation, which was the first study of aged persons, used time compression levels of 36, 46, and 54% at 40 dB re SRT.

Results of both the investigations indicated

that time altered speech was ineffective in differentiating young and aged listeners, nor did it effectively differentiate normal listeners from persons with sensorineural hearing impairments. These results were questioned by Beasley and Maki (1976) based upon the fact that the stimulus material employed may have been too easy to allow for differentiation between groups to occur.

Further, an inspection of data presented by these investigaters shows that the hearing losses were mild and not necessarily a problem for the sensorineural population. The two studies also employed limited sample sizes and compression levels.

Nevertheless, the studies by Luterman et al. (1966) and sticht and Gray (1969) provided the necessary impetus to investigators to pursue studies of the temporal nature of the auditory processing for clinical purposes.

The effect of time - compressed speech on the auditory discrimination abilities of ninety - six normal hearing young adults were studied by Schwimmer, Beasley, and Zemlin (1971), There were five conditions of time compression, 30% through 70% in 10% steps presented at 8, 16, 24, and 32 dB SL. In another study, Beasley, Schwimmer, and Rintlemann (1972) presented the time compressed word lists of Form B of the Northwestern University Auditory Test Number 6 (tillman and Carhart, 1966) to a group of 96 young adults using the same research paradigm, compression levels and ssensation levels as used by Schwimmer et al. (1971)+

Results of both the studies, considered separately, indicated that intelligibility was inversely related to time - compression ratio and directly related to sensation level. No right ear left ear differences were found. This is in agreement with the notation that monotic listening tasks (as opposed to diehotic

listening tasks) fail to reveal any clinically significant ear effects.

Beasley et al. study also pointed out that high ratios of time - compression as well as low sensation levels serve to increase the interlist variability. List IV was found to be the easiest and list I to he the hardest.

Beasley, Forman, and Rintelmann (1972) undertook to extend the data of Beasley et al.(1972) to provide normative data for clinical use. They obtained the data only at 40 dB sensation level (SL) re:SRT, since in a clinical setting, 40 dB SL is often utilized.

They presented the four lists of Form B of NU - 6 time compressed by 0 through 70% in 10% steps, to 16 normal hearing persons. The results incorporating Beasley et al (1972) findings show that PB Man (90%)is reached at 32 dB SL for all but 70% time-compression,

which may not have reached PB Max even at 40 dB SL.

The higher intelligibility of time-compressed sentences relati the time-compressed monosyllables results from the redundant nature of the sentential stimuli (Beasley et al., 1980).

The above findings necessitate studies to obtain normative data for various types of stimuli that have been used, time—compressed or otherwise, to obtain auditory discrimination scores. Working in these lines, Schwartz and Mikus (1977) attempted to standardize a time-compressed version of modified rhyme test (MRT) introduced by Kreul Et al. (1968), on a group of 60 normal-hearing young adult listeners.

Modified rhyme test is a test of word discrimination in the form of a closed set task consisting of six lists. A closed set formal has the advantage of reduced subject bias associated with previous linguistic knowledge, limited length of listening time to

familiarize subject with the test vocabulary, and requirement of written responses which minimize examiner bias (Schwartz and Mikus, 1977).

Stimuli were presented at 0, 30, 40, 50, 60 and 70% time-compression levels at 24 dBSL.

Results were conistant with earlier findings for the Nu—6 test lists and demonstrated that word discrimination decreased as a function of increasing percentage of time-compression. Also, differences among the lists were found to exist at high levels of time compression;

Freeman and Church (1977) investigated the ability of a group of normal young adults to recall and repeat a set of time-compressed five-word first-order sentential approximations. Four levels of time-compression (0,20,40, and 60%) were presented at four sensation levels (16,24,32, and 40 dB). The results

demonstrated that normal subjects are capable of recalling and repeating, without difficulty, four lists of the five-word first-order sentential approximation at various levels of time compression. The authors propose:

> " If it is true that many central auditory processing impairments affect memory and that auditory discrimination errors may be a by-product of, or co-exist with, an auditory memory deficit, then a sentential test which could measure both of these parameters might have diagnostic and clinical utility."

Far this reason, the authers used 'recall-and-repeat' as responses from subjects.

The intelligibility of time-compressed speech has also been reported to be influence by listeners' previous experience, word familiarity and native language (Foulke and Sticht, 1969; Henry, 1966 - cited by Foulke and Sticht, 1969).

To this effect, Nikam, Beasley, and Rintelmann (1976) studied the performance of 70. Non-Native speakers

of English on time-compressed versions of four lists of Form B of NU-6 (same as those used by Beasley et al., 1972). The results obtained were compared to the performance of Normal hearing native English speakers of Beasley et al. (1972) study. Indo-Dravidian and Spanish English-speaking subjects were given experimental stimuli at six time compression (0% and 30% through 70% in 10% steps) levels at sensation levels of 8,16,24, 32 and 40 dB SL.

In support of earlier studies, it was found that intelligibility decreased as the percentage of time compression increased, and as sensation level decreased. The adverse effects of time—compression could be offset upto 60% by increasing the presentation level.

A comparison of results to the study by Beasley et al., indicated that the native speakers of English performed better than did both the speakers of the Indo-Dravidian and the Spanish groups under nearly all

conditions of time compression and sensation levels. One of the things that this study points out is that the linguistic background has definite effect upon the performance of listeners on time-compression tasks. So it seems conceivable that norms on time—altered speech tests may differ from language to language.

Norms on time—compressed speech tasks may vary considerably far children owing to the greater variability of results. Performance on time compressed speech has also been reported to be influenced by chronological age.

Thompson (1973) presented 40 sentences, divided into two grammatically based difficulty levels, to children ranging in age from 5.6 to 9.6 years. The sentences were electro-mechanically time-compressed. She found that recall occuracy (termed comprehension) improved as a function of increasing age, decreasing sentence complexity and increasing time-compression.

Her data suggest that while the slower rates assisted the perceptual processing of the signal by the younger children, the older children tended to perform better under the more rapid rates than under the slower condition.

King and Weston (1974) studied the ability of children to recall electro-mechanicaily time-compressed three-, five-, and seven-, word sentences. They found that younger children had significantly more difficulty recalling sentences 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.

Maki (1974) was the first one to study the

discrimination performance of young children systematically on two measures of time compressed speech. The word identification by picture identification test and the phonetically balanced Kindergarten(PBK-50) lists were administered to 60 normal hearing children. Percentage correct scores improved as age and sensation level of presentation was increased and scores decreased with increasing time-compression. Scores on the WIPI were consistently higher and showed a smaller range than the PBK - 50.

In a parallel study by Beasley, Maki, and Qrchik (1976) obtaining intelligibility scores on time compressed versions of WIPI and PBK-50, similar results were obtained. The use of WIPI is therefore recommended to be used with younger children whereas PBK-50 could be used with older children. The closed message set format of the WIPI, unlike the PBK-50 which isopen-message set format, has been described as more applicable

to young children and children who exhibit speech and language problems.

Children's performance has also been studied on time-compressed version of half-list speech discrimination measures (Manning, Shaw, Maki and Beasley, 1975), The necessity of shortened speech discrimination measure with reduced testing time is greater for children than for adults as children's task attentiveness during testing tends to decrease more rapidly than adults. In the study by Manning et al., (1975) it was indicated that half-lists of the PBK-50 can be used effectively in the clinical testing with time-compressed tests.

Along the same lines, Orchik, Estrada, Danko, and Holgate (1976) also attempted to standardize time compressed version of WIPI on a group of Kindergarten-age children.

The above studies provide normative bases for

the use of time-compressed speech as a measure of auditory perceptual processing. It has been stressed that prior to be employed clinically, the temporally-altered measures must be studied adequately and evaluated with "non-normal", clinical groups of population. The findings should provide the basis for comparative studies with pathological subjects,as well as normative data for future clinical diagnostic purposes.

Earlier studies of clinical populations had restricted themselves to the use mainly measures of monosyllabic nature to patients with brain tumours, and old persons (Bocca and Calearo, 1963; de Quiros, 1964) and only recently have few studies dealt with populations presenting clinically significant pathologies.

Kurdziel and Noffoinger (1973) presented time-compressed (40 and 60%) monosyllables to seven patients with temporal lobe lesions and three with hemispherectomy.

The results revealed that with 60% time compression, a breakdown of discrimination in the ear contralateral to lesion occurred, in both groups of patiants. Break-down was neither as frequent nor as dramalic with 40% time-compressed material.

DeRuyter and Perrin (1974) studied performance of aphasic patients on time compressed nonsense syllable pairs. Time compression did not have any effects on aphasics discrimination, it was reported. However, Barry and Canter (1975) obtained contrary results when they found aphasic subjects performance to be affected on time compressed (50%) auditory comprehension task. It may be noted that DeRuyter and Perrin (1974) study used nonsense syllables and Barry and Canter used a more difficult and demanding comprehession task on which aphasic subjects performed poorly. Thus the problem faced by aphasics to follow time-compressed speech in Barry and Canter study may he more of a comprehension

problem rather than discrimination problem. Further investigations are required to validate this.

Dicarlo and Taub (1972) found that older aphasics perform poorer than young aphasics on time compressed material. Rudnick and Barry (1974) evaluated performance of normal and aphasic children an four-word first-and second-order sentential appcoximations. On comparison of results. It was found that stimuli were perceived best by normals regardless of rate of presentation whereas aphasics showed a decreased performance on timecompressed measures.

Konkle and Bess (1974), and Kankle, Beasley and Bess (1977) studied the elderly individuals performance on time compressed monosyllabic stimuli. In both the studies, the conclusion drawn was that the perceptual process of aged persons appears to breakdown as a function of increased time compression ratio and increased age.

Over time, it has been repeated confirmed that

time compressed speech is effective to differentiate between young and aged listeners, in that the performance of aged persons has been observed to be poorer (Bocca and Calearo, 1963; deQuiros, 1964; Sticht and Gray, 1969; Dicarlo and Taub, 1972; Konkle and Bess 1974; Konkle et al., 1977).

The detrimental effects of time compression upon the speech discrimination scores of aged persons have beenattributed to changes in the central and peripheral auditory processing mechanisms.

Kurdziel et al, (1975) reported a study of time-compressed speech using noise-induced hearing loss patients. The results obtained were commensurate with the data obtained on normal hearing listeners. However, the subjects demonstrated affect of reduced dynamic range in that the intelligibility was poor at all sensation levels irrespective of time compression when compared to normal discrimination measures. The authors therefore conclude that the testing using time—compressed speech should be done various sensation levels. They further

recommend that time compression levels of o, 40, and 60% be utilized for clinical purposes.

In another study, Kurdziel et al., (1976) presented data on 31 patients with known unilateral cortical lesions involving the temporal tobe;subjects were 15 patients with diffuse and 16 with discrete right or left temporal lobe lesions resulting from surgery. In the diffuse lesion group, subjects scored poorer in the ear contralateral to the lesion and also showed significantly greater difference scores between 0% and 60% time compressionas compared to the ipsilateral ear. In the discrete temporal lobe lesion group, ear differences were minimal. The investigators concluded that the time compressed tests were useful in detecting diffuse hemisphere lesions but were not particularly effective in detection of discrete temparal lobe lesions.

Snow et al. (1977 ; cited by Beasley and Freeman, 1977) demonstrated the effectiveness of the use of time compression in the detection of temporal lobe insult due to cerebrovascular accidents. Using a measure of synthetic

sentence identification with Ipsilateral (SSI - ICM) and contralateral (SSI-CCM) competing message and the performance intensity function for phonetically balanced words (PI-PB), only minimal or no differences were found between the two tasks. The time compression scores were substantially reduced on the centralateral ear compared to the ipsilateral ear, especially at 60% time-compression.

Studies using groups of hearing impaired individuals have shown that at each level of compression, the hearing-impaired group had lower mean performance scores, particularly under the higher time compression condition,. Further, PB Max was found to occur earlier under the lower compression conditions but continued to improve as a function of increasing sensation level under higher time compression conditions.

Kurdziel et al., (1976) presented several illustrations to support the importance of obtaining an optimum intelligibility score when employing time-compressed speech with hearing impaired persons. Generally, the difference in discrimination scores between

0% and 40% time compression for hearing impaired subjects was about 10 to 15% compared to less than 3% difference for normal hearing subjects.

Time-compressed speech tests have been used with children who exhibit various types of learning and communicative problems. It is a useful tool in the study of auditory perception in children.

Orchik and Oelschlaeger (1974) administered the word intelligibility by Picture identification Test, time compressed by 0, 30, and 60% to 48 children with articulatory defects. The children with multiple articulation errors demonstrated a developmental lag in the ability to process time-compressed speech.

Maki et al., (1976), using the WIPI stimuli time compressed, evaluated performance of normal and hearing impaired children in terms of response accuracy and mean reaction time. For the hearing impaired group, discrimination scores were lower, and response times longer than normals. The intelligibility at each level of time

compression was significantly affected by the degree of hearing loss. The difference scores between 60% and 0% time compression consistently ranged between 10 to 15% for all hearing-impaired subjects regardless of degree of hearing loss. Thus, these investigators recommended that difference scores between 60% and 0% time compression should be need to interpret data on hearing impaired subjects.

Freeman and Beasley (1976) investigated the performance of a group of normal reading and reading-impaired children on time-compressed version of sentential approximations and 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.

Freeman and Beasley suggest the use of 0% and 40% time compression levels for clinical diagnostic purposes when using sentential approximations.

More recently, Manning,Johnston, and Beasley (1977) performed PBK-50 time-compressed tests on 20 children diagnosed as having auditory perceptual disorders. Results indicated that these children performed equally well at both 0 and 30% time compression. Performance decreased significantly at 60%.

Several studies using various clinical groups are currently underway at various clinics (Beasley, 1980), Most of the investigations till date have only provided limited data and further research is required. The group mean discrimination scores at the various levels of time-compressions-used in various studies-have been reported to differ considerably, probably as a result of procedural and population differences.

However, the difference scores between 60% and 0% time compression have been found to be consistently similar for the variouspathological groups, and considerbly greater than those found for normal hearing subjects.

Thus, this consistency of difference between

0 and 60% time compression for pathological groups over various studies suggests that the difference scores may prove to be more useful clinically than the simple percentage correct scores at each time-compression level.

The use of both monosyllabic and sentential stimuli have their limitations. On one hand, where the monosyllabic stimuli fail to fully assess the central auditory processing, the sentential stimuli are complicated by such factors as word familiarity, length, and semantics and syntacties. Testing with sentantial stimuli also involves memory influences and only careful interpretation can tell about the exact nature of problem.

de Quiros (1964) listed some of the sources of error in the time compressed speech test. They include:

1. Attention and memory span:
2. Patient's sensory response;
3. Effects of lesion;

4. Patient's social, educational, and linguistic background; and
5. Experience and training of the audiologist.

Thus, the interpretation of time-compressed speech test results involves the skillful judgement of the audiologist considering all these factors.

The determination whether or not time-compressed speech test will ultimately he a part of the diagnostic test battery used by audiologists is subject to future research. With the recent increased interest in the measures of central auditory processing, the future seems promising.

-OOO-

Chapter 3

METHODOLOGY

This study was composed of two experimental conditions one involving the presentation of tape recorded four lists of Form B of the Northwestern University Auditory test number six (Nu-6) to a group of listeners and the record involving presentation of same four lists of form B of NU-6 which were time-compressed by 60% to another group of listeners. Each group consisted of 20 listeners with equal sex and ear ratios. All of them spoke english as their second language.

Subjects

Forty normal hearing young adults, ranging in age from 17 years and 8 months to 23 years and 8 months with a mean age of 20 years, from a university population served as subjects for this study. Each subject was required to;

1. have normal hearing in both the ears at octave

intervals from 250 Hz to 8000 Hz (re:ANSI, 1969)

2. Undergo a speech reception threshold (SRT) testing for the test ear with the central Institute fer the Deaf (CID) W-1 spondaic word list (see Appendix 1) The words were tape recorded by a trained male speaker ($f° = 95$ Hz) who spoke general American english. The SRT was obtained using the procedure described by Tillman and Olsen (1973). The mean SRT was 9.5 dB (range: 3 to 19,dB).

3. Have had a minimum of five years exposure to, and experience in, spoken English. This however was a gross criterion to ascertain that the subjects had sufficient exposureto spoken english.

4. Pass"a test of vocabulary range " (Lewis, 1968). The test was used to evaluate a fairly wide range of range of vocabulary items (see Appendix II). The scores obtained on the test ranged from 14 (23%) to 48 (80%) with a mean of 26.0 (43.4%) out of a possible sixty points, passing marks being 20%.

5. pass " a test of english ability" (CIEFL,1980). This test consists of six sections which evaluate usage of grammar, of articles, prepositions, and pronouns (see Appendix III). The scores obtained on the test ranged from 71.0% to 93.5% (M=82.78%).

Experimental Stimuli.

The stimuli used in this study were the four lists of Form B of Northwestern University Auditory test number 6 (Tillman and Carhart, 1966). The same stimuli as those utilized in Nikam et al. (1976) study. Each listis composed of 50 meaningful monosyllabic consonant-nuclues-consonant (CNC) words that have been phoneticaly balanced (see Appendix IV)

The four lists were tape recorded at normal conversational speech level by a trained white American male speaker (f_o= 95 Hz) who spoke General American English (Rintelmann et al., 1974). A copy of each list, time-compressed by 60% using the fairbanks electro-mechanical time-compress&on/expanslon asparatus

(Fairbanks et al., 1954), was also obtained.

Calibration

For the purpose of calibrating tape input of the audiometer, recordings of 500 Hz, 1OOO Hz, 2OOO Hz and speech spectrum noise were obtained on the tape at 60 dB HL, then this tape recordings were played through the audiometer tape channel and measurements of intensity variations made. They were found to be within permissible limits of variability (± 4 dB)+ The linearity was also checked (Kankle et al., 1981).

The tape recorder output response and audiometric calibration for tape input were done using Bruel and Kjaer audiofrequency analyzer type 2107, condenser microphone type 4144 and artificial ear type 4152.

The audiometer calibration was checked daily prior to beginning testing.

Tape recordings were played on a high speech Bruel and Kjaer level recorder type 2305, and the intensity peaks of each presentation were averaged for each

tape separately. The calibration tone of 1000 Hz was then recorded at equivalent level on each tape.

Presentation Procedure.

Forty subjects were divided into two groups corresponding to the two time compression conditions of 0 and 60%. One group of subjects received the control stimuli of 0% time compression and the othergroup was presented with 60% time-compressed word lists. There were an equal number of male and female listeners in each group. And an equal number of right and left ears were tested for males and females under each group. Therefore, under 0% time-compression, as also under 60% time-compression/ condition,right ear was the test ear for five males and five females and left ear for the other five males and five females.

Selection of a subject to a group, selection of the test ear, and the testing paradigm were all all randomly carried out for each subject.

There were five sensation levels in the study: 8, 16, 24, 32, and 40 dB (re: SRT). Each subject was presented with the four lists of form B of the NU-6. Each list was presented at one of the five sensation levels. Thus, there were only four sensation levels used for each subject. The presentation order of the lists, and the sensation levels were counterbalanced to avoid possible order effect and effect of sensation level presentation. In this way, since only four out of five sensation levels were used for each subject, there were sixteen discrimination scores obtained under each of the five sensation levels for a group of twenty listeners.

The standard set of instructions given to each subject were as follows:

> " You will be hearing to a series of simple meaningful vords spoken in foreign accent. Each word is preceded by a carrier phrase ' you will say .....' All that you have to do is to write the word down (on a sheet of paper) in the manner

> convinient to you, if you do not hear well the word, try to guess it; and if you do not still succeed, leave a blank space and go on to the next word. You will be listening to four lists of fifty words each. The audibility of each list will vary. You are not to bother about spelling, i.e., if there are words that can be spelt differently but sound the same (homophonous words), you may write any one spelling: Are you ready ...."

Each subject was tested individually in a sound treated test chamber with the experimenter seated in an adjacent control room. The ambient noise in the testing room was sufficiently low so as not to interfere with testing even at the lowest sensation level, (see Appendix V).

During the testing session, first a conventional puretone air-conduction test was given.Next, the CID W-l spondee word list was administered to the test ear only

and SRT obtained using the procedure described by Tillman and Olsen (1973).

The experimental stimuli were then presented to the subject via a Sonnet tape recorder coupled with a Maico diagnostic audiometer model MA 22. The subject heard the stimulus words through a TDH 39-10Z earphone mounted in MX 41/AR cushion. The frequency response characteristics of the earphone were flat in the frequency range of 5O-5OOO Hz writeen responses were obtained from the subjects and analyzed. A rest period was given between the presentation of each word list. The whole testing procedure was completed in a single session which lasted one hour.

Data Analysis.

There were 16 scores under each sensation level for each group (8 right ears, 8 left ears) and 20 subjects for each of the time compression levels (10 right ears, 10 left ears). Written responses were converted into percentage correct scores for each of the subject.

The effect of time-compression on percentage correct scores obtained by each subject was studied Interactive effect of time compression and sensation level on intelligibility was also studied.

A comparison of the results obtained in the present study was made to an earlier study by Nikam et al., (1976) andother contemporary studies.

Appropriate statistical measures were applied to arrive at meaningful results and the results were discussed.

-000-

Chapter 4

RESULTS

The subjects' responses were analyzed and converted into percent correct scores. The mean percent scores for the right and left ears were essentially equivalent under both 0 and 60 percent time-compression conditions - and thus the data were combined and subjected to statistical analysis.

Mean percent correct scores and standard deviations under each percentage of time—compression, at various sensation levels were computed as shown in Table 1. The articulation - gain functions for both the time compression conditions are shown in Figure 1. The data was subjected to F - statistics in testing the significance of the variance that could be attributed to the two main effects of time compression and sensation level, and the mian interaction. The results of tow-way ANOVA are shown in Table 2.

Effect of time-compression:

The mean percent correct score, collapsed over sensation level, under 0% time-compression condition was 75.75 percent correct and that under 60% condition was 61-4 percent correct (Table 1). These results indicate, as can be seen from Fig. 1, that the subjects performed better under 0% condition. However, an statistical analysis, this effect of time-compression was found to be not significant; though the results show a general trend that follows findings of earlier studies (Beasley et al., 1972; Kankle et al., 1977; Beasley et al., 1980).

Effect of Sensation Level ;

A reference to Figure 1 indicates, apparently, that as the sensation level of presentation is increased, the intelligibility performance also increased. The in-telligibility performance also increased. The mean percent scores at 8 dB sensation level were 64.87 and 49.75 percent correct at 0 and 60% time compression respectively ; and those at 40 dB sensation level were 82.62 and 72.5 percent

correct respectively. The slopes of the articulation curves computed between 8 and 16 dB sensation levels for the two time-compression conditions (0 and 60%) were 0.86 and 0.81 percent correct per decibel increase.

This apparent increase in performance with increasing sensation level was however insignificant on statistical analysis.

Time-Compression X Sepsation Level

The maximum discrimination score (PB-Max) is reached at 32 dB sensation level under 0% time-compression condition; whereas under 60% condition slight improvement in score can be observed upto maximum sensation level.

-oOo-

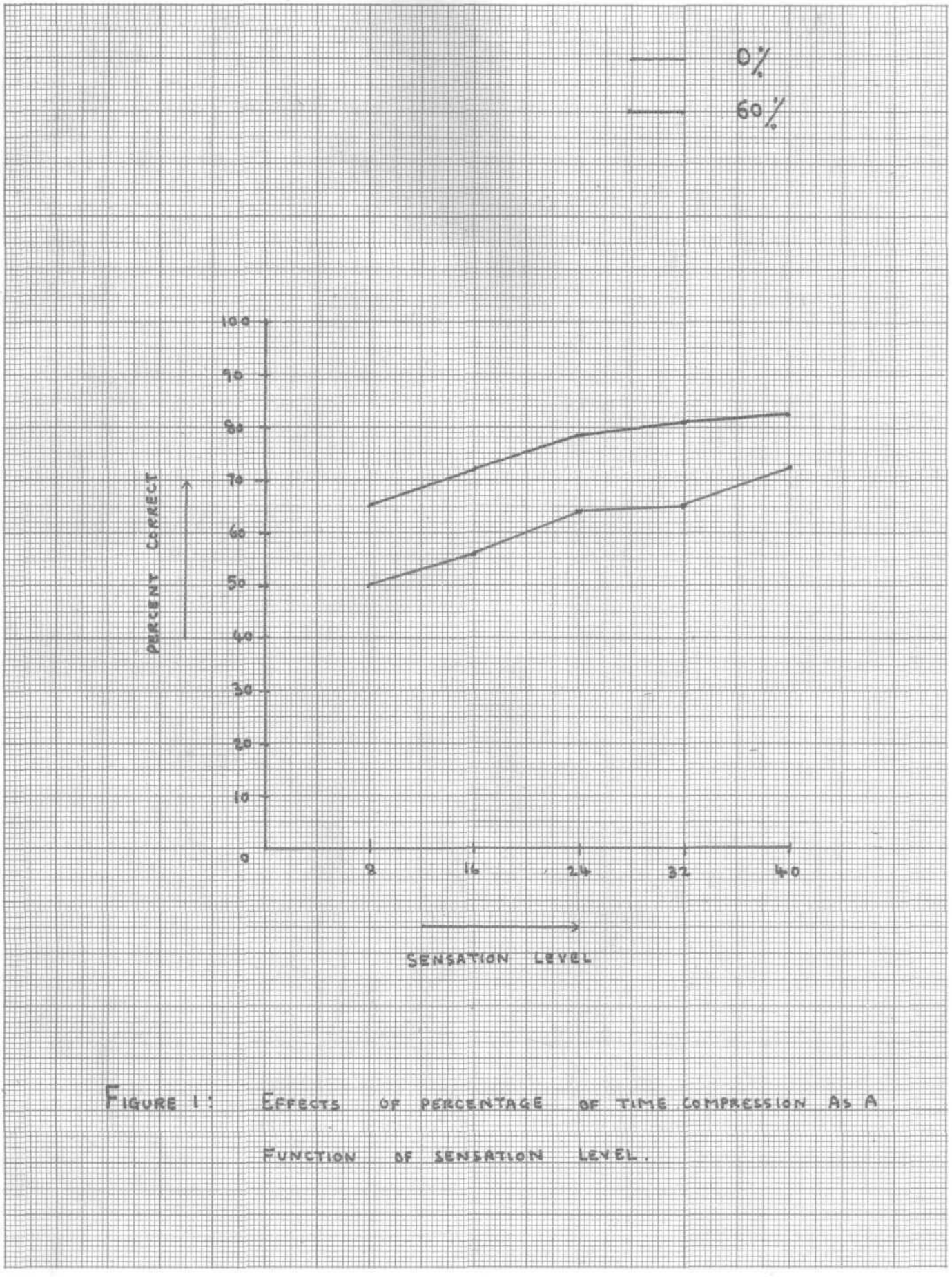

FIGURE 1: EFFECTS OF PERCENTAGE OF TIME COMPRESSION AS A FUNCTION OF SENSATION LEVEL.

Table 1: showing the Mean percent correct scores and Standard Deviation (SD) at various sensation levels for the two time-compression conditions.

Senation level (dB)	Time-comperssion 0%		60%	
	X(%)	SD(%)	x(%)	SD(%)
8	64.87	6.40	49.75	6.57
16	71.75	7.20	56.25	5.31
24	78.37	7.87	63.87	9.28
32	81.12	8.91	64.62	8.44
40	82.62	7.36	75.20	6.04
Total	75.75	—	61.40	—

Table: 2 Results of Two-way Analysis of Variance (ANOVA) for the main effects of time-compression and sensation level.

Source of Vaiiance	df	Sum of Squares	Mean sum of squares	F ratio	
Column (Time-compression)	1	8820.9	8820.9	2.02	not significant
Row (Sensation level)	4	9054.35	2263.58	0.520	not significant
Interaction (Time compression X Sen-sation level)	4	266.35	66.58	0.015	not significant
Error	150	652638.4	4350.9	-	-
Total	159	670780.0	-	-	-

Chapter 5

DISCUSSION

This study demonstrates results contrary to the earlier studies in that the significant inverse relationship between intelligibility and time-compression, direct relationship between intelligibility and sensation level, and the time—compression X sensation level, interaction were not observed. It is difficult to make direct comparison between present study and other studies because of the difference in subjects. While this study attempts to study how non-native listeners perform on a time-compressed speech discrimination task, others mostly studied native listeners.

Effects of Time-Compression

Earlier studies, using both normal (Beasley et al., 1972; Nikam et al., 1976; Beasley et al., 1980) and clinical groups of subjects (Kurdziel et al. 1975; Manning et al., 1977), have demonstrated that as the level of time-compression was increased, the discrimination performance decreased significantly. The present

study, although observed this trend, found it to be insignificant.

The lack of this significant effect could be attributed to a number of factors. The time compression is meant to reduce the external redundancy of the stimuli. This reduction in redundancy may not be of any importance to the non-native listeners, since to begin with, under normal conditions, the non-native listeners may not make use of all redundancy clues, On the other hand, the Native speaker habitually utilizes all these clues and witholding these clues will adversely effect their performance.

The assumption is that the extrinsic redundancy of stimuli helps the listener in perceiving stimuli. This may he true for the native speakers, the non-native speakers may not be able to take advantage of this redundancy. This may be because of the variations in number and sequencing of words and because the languages differ in the linguistic contexts at different levels.

A comparison of this study can be made with the Nikam, Beasley, and Rintelmann (1976) study (figure 2). In contrast to the present study, Nikam et al., (1976) study investigated the intelligibility of time-compressed CNC monosyllables using English knowing listeners whose native languages were Spanish or Indo-Dravidian, but who had been exposed to general American dialect. The etimuli used were same in both the studies.

Among other factors, familiarity and experience with the dialect in which the message is spoken, and message familiarity have been demonstrated to influence speech discrimination ability (Lane, 1963). Therefore, the Indo-Dravidian listeners of the Nikam et al., study were expected to perform better than the subjects in the present study.

A comparison of results indicates that, as expected, the performance of Indo-Dravidian group was better than the group of subjects in the present study under 0% time-compression condition. But subjects in

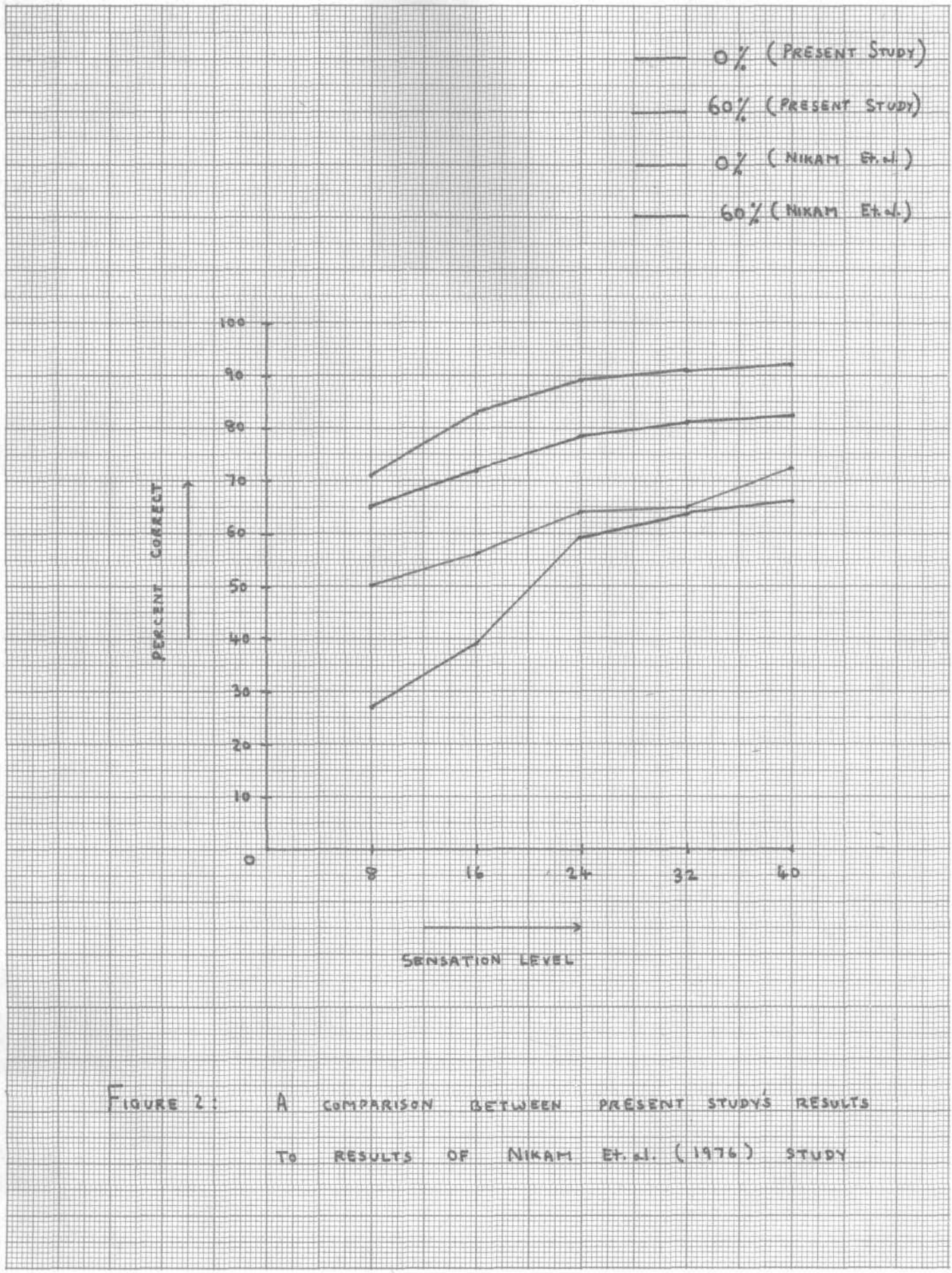

FIGURE 2: A COMPARISON BETWEEN PRESENT STUDY'S RESULTS TO RESULTS OF NIKAM Et. al. (1976) STUDY

the present study performed better than the Indi-Dravidian group under 60% condition. The mean percent correct score obtained by Indo-Dravidian listeners in Nikam et al., study under 0% condition was 85.2% correct, compared to 75.75% correct in the present study. The mean percent correct scores under 6O% condition were 51.1 and 61.4% correct for the two groups respectively. Native listeners (Beasley et al., 1972) however performed better than subjects of present study at both time-compressions.

The Indo-Dravidian listeners, being more accustomed to the General American dialect of the speaker, should have performed better under time-compression. Assuming that foreign accent does not have any effect upon the intelligibility for non-native speakers. Still the performance of the two groups should have been identical.

This disparity cannot be accounted for simply but for the reason that probably the ward lists were familiar to the subjects in the present study, thus enabling them to perform better. This explanation, however, doesnot

seem plausible. A more acceptable reason would be that the subjects in the present study belonged to a selected group of university population. The subjects in the present study were those enrolled in professional courses at graduate or post-graduate levels. On the other hand, subjectsin the Nikam et al., study belonged to diverse educational backgrounds. To this effect, Watts (1971) reported that Army officers with higher education performed better than the non-commissioned officers who had less than college education on time-compression tasks. But if we accept these reasons, than, why did the subjects in this study perform poorly at 0% time compression ?

For this, it may be reasoned, as woodcock and Clark (1968; in Manning et al., 1977) pointed out, that when speech is presented at a rate slower than an individuals optimum auditory processing rate, extraneous variables are apt to interfere with the processing of the primary signal. Moreover, it was personally felt by many subjects under 0% time compression condition that

" the rate of speech was markedly slow." In fact, the recorded material at 0% was presented at a rate slower than that to which subjects of present study are accustomed. This " slow rate" could have brought same extraneous variables into effect thus resulting in performance decrement at 0% time-compression condition In general, the Indian languages and English spoken in India, are spoken at a faster rate (Bharadwaj, 1979).

Inaddition, there are studies that support the notation that various forms of signal distortion have limited effect upon non-native speakers when compared to native speakers (Rouse and Tucker, 1966).

Johnson and Friedman (1971) found that the time-compressed secena language stimuli were lessseverely affected in bilinguals.

Therefore, where on one hand, the performance at 0% is adversely affected by certain factors, the performance at 60% is facilitated, on the other. This in

effect, closes down the gap between performance at 0% and 60%, thus rendering the main effects of time-compression insignificant.

As it stands out, therefore, it may be stipulated that the performance of subjects in the present study could have been better if the rate of recorded message presentation was faster. Some of the studies lend support to this effect when they report that the performance of subjects either remained some or "actually" improved at a time-compression ration of 30%, compared to their performance at 0% (Beasley et al., 1972 ? beasley et al., 1976).

Sensation level

A number of studies, including those with clinical groups (Kurdziel et al., 1975 ; Mannin et al., 1977; Konkle et al., 1977), have reported that the discrimination scores improved with increasing sensation level. Though this trend was observed in the present study, it was found

to be insignificant. The sloped of the articulation function when computed between 8 and 16 dB sensation levels were found to be 0.86 and 0.81 percent per dB increase in presentation level at 0 and 60% time compression conditions respectively. The slopes are much flatter than those obtained by Nikam et al. (1976) for the Indo-Dravidian group (1.48 and 1.51%/dB at 0 and 60%, respectively).

The results of 0% time-compression condition are comparable to those obtained by Malini's (1981) study which utilized form A of NU-6, recorded by an Indian male speaker. As expected, the overall performance of Malini's subjects was Better than the performance of subjects in present study. On closer observation, it was found that at lower sensation levels, the performance of subjects in present study was better, whereas at higher sensation levels, the subjects in Malini's (1981) study performed better.

This, and the previous findings of less steeper

articulation functions, indicates that subjects in the present study did not show a proportionate hike in discrimination scores with increasing sensation levels. Although, their performance was better at lower levels, they could not extend it proportionately to the higher levels.

A similar trend is observed when we compare parformance of Indo-Dravidian and Spanish speakers (Nikam at al., 1976) to the performance of native speakers (Beasley et al., 1972). The articulation curves of Spanish and Native speakers, which are very close at lower sensation levels, tend to diverge at higher levels-with native speakers showing markedly better performance.

It appears that certain linguistic constraints imposed by the foreign accent or lack of familiarity, which restrict the individual's performance, cannot be overcome by increasing the level of signal presentation Probably, during the assessment of non-native speakers,

high sensation levels fail to provide any positive, additional clues to enhance intelligibility

Time-Compression X Sensation level Interaction

The performance decrement at high levels of time—compression can be offset by increasing the sensation level. This interaction was not observed in the present study. Since no significant improvement in intelligibility occurred in relation to sensation level interaction does not occur, where on one end, the time compression hapered the intelligibility performance, the increase in sensation level, on the other end, could not overcome the linguistic restrictions imposed by foreign accent and other linguistic factors to cause on increase in intelligibility scores. The sensation level increase proved ineffective and thus interaction occurred.

Atypical results have been reported in dichotric listening tasks also for which no explanation other than individual differences is given (Barter and Berlin, 1975).

The results of the present study are complicated by the interactive effects of time compression and foreign accent and any conclusions are unwarranted.

While this study demonstrates the influence of foreign accent, presumably, and time compression, it stresses the fact that measures of speech discrimination should be used with caution while testing non-native speakers and that interference by certain factors, as foreign accent, results in ambiguous findings. It should be noted that as the conditions become more difficult, score variability and ambiquity of results is apt to increase (Beasley et al., 1976).

It is necessary to obtain normative data using standard clinical procedures. It is impertive that further investigations employing standard stimuli and clinical procedures be carried out on normal as well as various clinical groups. The acquisition of such data is necessary in order for the time compressed speech stimuli to be used validly and reliably in clinical findings.

-0O0-

SUMMARY AND CONCLUSIONS

This study reports on the performance of forty young adults on time-compressed version of four lists of form B of Northwestern University Auditory test number 6 recorded in foreign accent. The study aimed at:

1) analyzing the influence of foreign accent on performance of listeners who have not been exposed significantly to it, and 2) establishing a pattern of performance of subjects to see if the test can be used in Indian set-up. Time compression levels of 0 and 60% wre used at five sensation levels (8, 16, 24, 32, and 40 dB).

The results follow the earlier trend in that the performance decreased at higher time compression and increased with increasing sensation level. However, this relationship was not found to be statistically significant. The time-compression X sensation level interaction was not observed found in the results that is, the performance decrement caused by increasing the sensation level.

The results are complicated by the interactic effects of time-compression and foreign accent, and any conclusions are unwarranted.

While the study demonstrates the influence of foreign accent, presumably, and time compression, it stresses the fact that measures of time compression should be used with caution while testing non-native speakers and that the interference by certain factors renders ambiquous results.

Suggestion for further research

The study could be extended over a larger sample of population to establish norms using time empressed material of native language. And the studies of clinical population may also be done, Further studies on the influence of foreign accent on time-compressed speech discrimination ability may be useful, especially in multilingual country like India.

-000-

BIBLIOGRAPHY

American National Standard Specification for Audiometers (ANSI S3.6), 1969. American National Standards Institute Inc., N.Y.

American National Standard Criteria for Back ground Noise in Audiometric Rooms (ANSI S3.1), 1971. American National Standards Institute* Inc., N.Y.

" A Test of English Language" Central Institute of English as foreign Language, 1980

Barry, M.Klar, and Canter, Gerald J., " The effect of Time-Altered Speech on the Auditory comprehession of Adult Aphasis", ASHA 17, Paper presented at the Annual meeting of the American Speech & Hearing Association, 1975

Beasly,D..S., Bratt, G.W., and Rintlemann, W.F., " Intelligibility of Time - compressed sentantial stimuli," J.Speech Hearing Res., 23, 722-731, 1980

Beasley,D.S. Farman, B.S. and Rintlemann, W.F., " Perception of Time compressed CNC Monosyllables by Normal Listeners", J. Aud. Res., 12, 71-75; 1972

Beasley,D.S., and Freeman,B.A., "Time Altered speech as a Measure of Central Auditory Dysfunction," in R.W.Keith (Ed.), "Central Auditory Dysfunction," Grune and Stratton, N.Y., 1977.

Beasley,D.S., and Maki,J.E., " Time and frequency - Altered Speech", in N.J.Lass, " Contemporary Issues in Experimental Phonetics," Academic Press, Inc., N.Y., 1976.

Beasley, D.S., Maki J.E., and Archik, D.J. "Children's Perception of Time-Compressed Speech on Two Measures of Speech Discrimination," J.Speech Hearing Pis., 41, 216-225, 1976.

Beasley,D.S, and Rintlemann, A., "Children's perce-ption of Temporally Distorted sentential approximations of varying length, "Audiology, 15, 315-325, 1976

Beasley,D.S. Schwimmer,S., and Rintlemann, W.F., " Intelligibility of Time-compressed CNC Monosyllables," J. Speech Hearing Res., 15, 340-350, 1972

Beasly,D.S., and shriner, T.H., "Auditory Analysis of Temporally Distorted sentential Approxi-mations" Audiology, 12, 262-271, 1973

Bhardwaj, A.K., Personal Communication. 1979

Bratt, G.W., " The effects of Time compression on the Intelligibility of three sentential Message Tests," ASHA, 18, 671 (T - 4), Paper presented at the Annual Meeting of ASHA, 1976

Calearo, C, and Lazzarani,A., "Speech Intelligibility in Relation to the speed of the Message" " Laryngoscope", 67, 410-419, 1957

de Quiros, J., " Accelerated Speech Audiometry: An examination of test Results," Trans. by J.Tenndorf, Translation of the Beltone Institute of Hearing Research, No.-17, 1964.

De Ruyter,F., and Perrin, K.L., "The effect of time-Altered speech on the Auditory discrimination ability of Anhasis" ASHA, 16, 523 (Th - 5), Paper peesented at the Annual Meeting of ASHA, 1974

Dicarlo. L., and Taub H., " The influence of Compression and Expansion on the Intelligibility of speech by young and Aged Aphasic individuals." J.Commun. Dis. 5, 299-306, 1972

Fairbanks, G., Guttman,N., and Miront, M.S., "Effects of time compression upon the Comprehension of connected Speech", J.Speech Hearing Dis., 22, 10-19, (1957 a)

Fairbanks G.Guthman,N., and Miron,M.S., "Auditory Comprehession of Repeated High-Speed Messages," J.Sneech Hearing Dis., 22,10-22 (1957 b)

Foulke,E., and Sticht T.G., " Review of Research on the intelligibility and Comprehension of of Accelerated Speech," Psych. Bult., 72, 50-62 1969.

Freeman,B.A. and Beasley D.S. " Performance of Reading-Impaired and Normmal Reading children on Time-Compressed Monosyllables and sentential stimuli," ASHA,18,603 (Sa-30), paper presented at the Annual meeting of ASHA, 1976.

Freeman,B.A. and ChurchG., "Recall and repetition of Time - compressed sentential appropri-mations by normal Hearing young adults," J. Am. Audiotry Soc., 3(1), 47-51, 1977

GarWey, W.D., " The Intelligibility of speeded speech," J.Experimental Psych. 45, 102—107, 1953

Johnson,R.L. and Friedman, H.L., "Some temporal factors in the listening behavior of second language students," In G.E. Perren and J.L.M. Trim (Eds.) Application of Linguistics," University Press, London, 1971.

Jerger J., " Diagnostic Audiometry," in J.Jerger (Ed.), " Modern Developments in Audiology," Academic Press, N.Y., 1973.

Katz,J, " The use of staggered spondee words for assessing the Integrity of the Central Auditory Nervous system," J.Aud.Res., 2, 327-337, 1962

Keith, R.W., " Synthetic sentence Identification Test," In R.W. Keith (Ed.) "Central Auditory Dysfunction Grune and Stratton, N.Y. 1977

King, K.M., and Weston, P.L., " The effect of the percentage of time compression sentence length, and Age on Children's Recall performance of Well—formed sentences," ASHA, 18, paper presented at Annual conference 1974.

Konkle, D.F., Beasley,D.S., and Bess, F.H., "Intelligibility of Time-Altered speech in relation to chronological Aging," J.Speech Hearing Res., 20(1), 108-115,1977

Konkle,D.F., and Bess,F.H., " Perception of Time-compressed CMC Monosyllables in an Aged population," ASHA, 16, 514 (W-10), paper presented at the Annual Meeting of ASHA 1974.

Konkle,D.F., Freeman,B.A., Riggs,D., Riensche,L.L. and Beasley,D.S., "Calibration Procedures for Time-compressed/Expanded Speech," (unpublished). Personal communication.1981

Korabic, E.W., Freeman, B.A., and Chruch,G.T., "Performance of Normal-Hearing Young Adults and Elderly subjects on time expanded speech tests," ASHA, 18, 671 (T - 4), Paper presented at the Annual meeting of ASHA, 1976.

Kurdzeil,S.A and Noffsinger, D., " Performance by cortical Lesion patients on 40% and 60% Time-compressed speech materials," ASHA 15, 469 (SU - 37), paper presented at the Annual meeting of ASHA, 1973.

Kurdzeil,S.A., Noffsinger,D., and Olsen, W., "Performance by cortical lesion patients on 40 and 60% time compressed materials," J.Amer Audiol. Soc. 2, 3-7, 1976

Kurdzeil,S.A. Rintelmann, W.F., and Beasley,D.S., "Performance of Noice-Induced Hearing-Impaired listeners on time-compressed consonant-Nucleus-consonant Monosyllables". J-Am.Audiol.Soc. 1(2), 54-60, 1975.

Lane,H. " Foreign Accent and Speech Distortion," J. Acoust. Soc. Amer., 35, 451-453, 1963

Lewis, N., " Word Power made Easy" pocket books N.Y. 1968.

Lutermann,D.M., Welsh O.L., and Melrose, J., " Responses of Aged males to time-altered speech stimuli," H.speech Hearing Res., 9, 226-239 1966

Maki, J.E., " Children's perception of time-compressed speech using two measures of speech Discrimination, ASHA 16, 523 (Th - 4), paper presented at the Annual meeting of ASHA, 1974

Maki,J.E., Beasley,D.S, Shoup,J.E., and Bess,F.H. "Speech discrimination and response latency of normal-hearing and hearing-impaired children as a function of time-compression, ASHA, 18, 671 (T-4) paper presented at annual meeting of ASHA, 1976.

Manning, W.H., Johnston,K.L., and Beasley,D.S., " The performance of children with Audiotry perceptual disorders on a time-compressed speech discrimination measure, " J.Speech Hearing Dis., 42, 77-84. 1977

Manning, W.H. Shaw, C.K., Maki.J.E., and Beasley D.S., " Analysis of Halfvlist scores on the PB-K 50 as a function of time-compression and Age," J.Am. Audiol. Soc, 1(3), 1O9-111, 1975.

Nikam,S, Beasley,D.S., and Rintelman, W.F., "Perception of time-compressed CNC Monosyllablas by Non-Native speaker/listeners of English," J.Am.Audiol Soc. 2(2) 45-48, 1976.

Orchik,D.J., Estrada,E., Danko.M.C, and Holgate,S. " Time-compressed speech discrimination, Reading readiness, and the effect of clinical method," ASHA 18, 672 (T-4) paper presented at the Annual Meeting of ASHA, 1976.

Orchik,D.J. and Oelschlaeger, " Time-compressed Speech discrimination in children and its relationship to articulation,% J.Am. Aduiol. Soc.3,37-41, 1973

Riensche,L. Lawson,G.Beasley,D.S., and smith,L.L. "Age and sex differences on preferred listening rates for speech, " J.Aud. Res.,, 19, 91-94, 1979.

Rintelmann, W.F. et al., " six experiments on speech discrimination utilizing CNC Monosyllables: Northwestern University Auditory test No. 6," J.Aud. Res., Suppl: 2, 1-30, 1974.

Rouse,R.O. and Tucker, G.R., " An effect of delayed Auditory feedback on speech in American and Foreign students," J.Speech Hearing Res., 9, 456-460, 1966

Rudnick,K., and Berry, R.C., " perception of rate Altered sentential approximations by Normal and Aphasic Children," ASHA, 16, 523, (Th-5), paper presented at the Annual Meeting of ASHA, 1974.

Schwartz,D.M. and Mikus,B., " Performance of Normal Hearing listeners on the time-compressed modified Rhyme test," J.Am. Audiol. Soc., 3(1), 14-19, 1977.

Schwimmer, S., Beasley,D.S., and Zemlin, W.R., " effects of time-compression on speech discrimination scores using CNC words (NU - 6)," ASHA, 13, 563 (SA-7), paper presented at the annual meeting of ASHA, 1971

Sticht, T.C and Gray,B.B., " The Intelligibility of time-compressed words as a function of age and Hearing loss," J.Speech Hearing Res., 12, 443-448, 1969.

Thompson, N.W., " Comprehension of Rate-controlled speech of varying linguistic complexity by Normal children," paper presented of annual conference of ASHA, 1973

Tillman, T., and Olsen, W., " Speech Audiometry," In J. Jerger (Ed.), "Modern developments in Audiology," Academic press, N.Y., 1973.

Walts, M.W., " Differences in educational level and subject-matter difficulty in the use of compressed speech with adult military students," Adult Educ. J., 21, 27-36, 1971

Willeford,J., " Audiological evaluation of control Auditory Disorders," Maico Audiol. Libr. series, 6, 1-7, 1969.

A P P E N D I C E S

APPENDIX A

List of Spondaic words used in the present study. *

Hard house	Play ground
Padlock	Oatmeal
Eardrum	Northwest
Sidewalk	Woodwork
Cowboy	Stairway
Mushroom	Hot dog
Farewell	Headlight
Workshop	Pancake
Horseshoe	Birthday
Duckpend	Grreyhound
Baseball	Mass trap

* Rintlemenn, W.F. et al., " Six experiments on speech discrimination utilizing CNC Monosyllables: Northwestern University Auditory Test No. 6," J. Aud. Res. Suppl. 2, 1-30, 1974.

Railroad	School boy
Hardware	White wash
Toothbrush	Inkwell
Airplane	Doormat
Iceberg	Day break
Arm chair	Draw bridge
Grandsan	Sunset

APPENDIX B

A test of verabulary range *

Here are sixty brief phrases, each containing one word typed in capitals. Check the closest definition of each such word. To keep you score valid, refrain, as far as possible, from wild guessing.

1. DISHEVELED appearance: (a) untidy, (b) fierce, (c) follish, (d) peculiar, (e) unhappy.
2. a BAFFLING problem: (a) difficult, (b) simple, (c) puzzling, (d) long, (e) new
3. LENIENT parent: (a) tall, (b) not strict, (c) wise, (d) foolish, (e) severe
4. REPULSIVE personality: (a) disguesting, (b) attractive, (c) normal, (d) confused, (e) conceited

* Lewis, N., "word power made easy",pocket books, Inc., 1968.

5. AUDACIOUS attempt: (a) useless, (b) bold, (c) foolish, (d) crazy, (e) necessary

6. AGILE climber : (a) lively, (b) tired, (c) skillful, (d) careful, (e) stubborn

7. PREVALENT disease: (a) dangerous, (b) catching, (c) childhood, (d) fatal, (e) widespread

8. OMINOUS report: (a) loud, (b) threatening, (c) untrue, (d) serious, (e) unpleasant

9. an INCREDIBLE story: (a) true, (b) interesting, (c) well-known (d) unbelievable, (e) unknown

10. a good OCULIST: (a) eye doctor, (b) skin doctor, (c) foot doctor, (d) bone doctor

11. will SUPERSEDE the old law: (a) enforce, (b) specify penalties for, (c) take the place of, (d) repeal, (e) continue

12. an ANONYMOUS donor: (a) generous, (b) stingy, (c) well-known (d) one whose name is not known, (e) reluctant

13. performed an AUTOPSY: (a) examination of living tissue, (b) examination of a corpse to determine

the cause of death, (c) process in the manufacture of optical lenses, (d) operation to cure on organic disease, (e) series of questions to determine the causes of delinquent behaviour.

14. an INDEFATIGABLE worker: (a) well-paid, (b) tired, (c) skillful (d) tireless, (e) pleasant.

15. A confirmed ATHEIST: (a) bachelor, (b) disbeliever in God (c) believer in religion, (d) believer in science,

16. a LOQUACIOUS woman: (a) tall, (b) beautiful, (c) homely, (d) sweet, (e) talkative

17. a GLIB talker: (a) smooth, (b) awkward, (c) loud, (d) friendly (e) boring

18. to PHILANDER: (a) work hard, (b) make love triflingly, (c) Save money, (d) be in doubt* (e) try unsucessfully

19. an 0CULAR difficulty: (a) unexpected, (b) insurmountable, (c) pertaining to the eye, (d) real, (e) imaginary

20. questionable PATERNITY: (a) fatherhood, (b)

(b) truthfulness (c) value, (d) knowledge, (e) wisdom

21. a NAIVE ATTITUDE: (a) unwise, b) Hostile, (c) unsophisticated, (d) friendly, (e) contemptuous

22. Living in AEELUENCE: (a) dirt, (b) countrified surroundings, (c) fear, (d) wealth, (e) poverty

23. more pleasant in RETROSPECT, (a) back view, (b) freedom (c) acceptance, (d) leisure, (e) anticipation

24. a real GOURMET: (a) teacher, (b) greedy eater, (c) vegetarian, (d) connoisseur of good food, (e) antique

25. to STIMULATE interest: (a) pretent, (b) feel, (c) lose, (d) stir up, (e) ask for

26. a MAGNANIMOUS action* (a) puzzling, (b) generous, (c) foolish, (d) unnecessary, (e) wise

27. a CLANDESTINE meeting: (a) prearranged, (b) hurried (c) important, (d) secret, (e) periodical

28. the APATHETIC populace: (a) made up of various national stocks, (b) keenly vigilant of their rights, (c) densely packed, (d) indifferent, uninterested, (e) prehistoric

29. to PLACATE his wife: (a) divorce, (b) make a gift to, (c) make arrangements for (d) help, (e) change hostility to friendliness

30. VACILLATE continuously: (a) avoid, (b) waver mentally, (c) inject, (d) treat, (e) scold

31. a NOSTALGIC feeling: (a) nauseated, (b) homesick (c) sharp (d) pinful, (e) delighted

32. feel ANTIPATHY: (a) bashfulness, (b) stage fright, (c) friend liness, (d) hostility, (e) suspense

33. be more CIRCUMSPECT: (a) restrained, (b) confident, (c) cautious, (d) honest, (e) intelligent

34. an INTREPID campaigner: (a) fearless, (b) eloquent, (c) popular, (d) experience (e) famous

35. DIAPHANOUS material: (a) strong, (b) sheer and gauzy, (c) colorful, (d) expensive, (e) sleazy

36. a TACITURN host (a) stingy (b) generous, (c) disinclined to conversation, (d) charming (e) gloomy

37. to MALIGN his friedn: (a) accuse, (b) help financially, (c) disbelieve, (d) slander, (e) discard

38. a CONGENITAL deformity: (a) horrible, (b) crippling, (c) slight, (d) incurable, (e) occurring at or during birth

39. a definite NEUROSIS: (a) plan, (b) emotional maladjustment, (c) mental derangement, (d) feeling or fear, (e) physical reaction

40. took an UNEQUIVOCAL stand: (a) indedisive, (b) well-intentioned (c) unexpected, (d) definite, (e) dangerous

41. VICARIOUS enjoyment: (a) complete, (b) unspoiled, (c) occurring from a feeling of identification with another, (d) long continuing, (e) temporary

42. PSYCHOGENIC ailment: (a) incurable, (b) contagious, (c) caused the emotions, (d) intestinal, (e) imaginary

43. an ANACHRONOUS attitude: (a) unexplainable, (b) religious, (c) belonging to a different time, (d) out-of-place, (e) unusual

44+ his ICONOCLASTIC phase: (a) artistic, (b) sneering at tradition, (c) troubled, (d) difficult, (e) religious

45. a TYRO: (a) dominating personality, (b) beginner,
(c) accomplished musician, (d) dabbler,
(e) serious student

46. a LACONIC reply: (a) immediate, (b) assured,
(c) terse and meaningful, (d) unitelligble,
(e) angry.

47. SEMATIC confusion: (a) relating to the meanings of
of word (b) pertaining to money, (c) having
to do with the language (d) relating to
mathematics, (e) scientific

48. CAVALIER treatment; (a) courteous, (b) high-handed
(c) Nagligent, (d) incomplete, (e) expensive

49. an ANAMALOUS situation: (a) dangerous, (b) intriguing,
(c) unusual, (d) pleasant, (e) unhappy

50. POSTHUMOUS child: (a) cranky, (b) brilliant beyond
his years, (e) physically weak, (d) illegi-
timate, (e) born after the death of his father,

51. feels ENERVATED: (a) full of ambition, (b) full of
strength, (c) completely exhausted, (d)
troubled, (e) weak

52. shows true PERSPICACITY: (a) sincerity, (b) mental
keenness, (c) love, (d) faithfulness, (e)
longing

53. a SYCOPHANTIC attitude; (a) sneering, (b) unbelieving (c) bootlicking, (d) surprising, (e) contemptible

54. GREGARIOUS person:(a) calm, (b) company-loving, (c) untrustworthy, (d) vicious, (e) self-sacrificing

55. sufficiently PHLEGMATIC: (a) satisfied, (b) annoyed, ((c) high strung, (d) emotionally calm, (e) irritating

56. CONSUMMATE scoundrel: (a) repentant, (b) punished, (c) perfect, (d) vicious, (e) unreformable

57. an EGREGIOUS blunder: (a) outstandingly bad, (b) slight, (c) irreparable (d) unnecessary, (e) humorous

58. CACOPHONY of the city: (a) political administration, (b) crowded living conditions, (c) cultural advantages, (d) harsh sounds, (e) foul odors.

59. a PRURIENT adolescent: (a) tall and gangling, (b) sexually longing, (c) clumsy and awakward, (d) pimply faced (e) soft-spoken

60. UXORIOUS husband: (a) henpecked, (b) suspicious, (c) guilty of infidelity, (d) fondly and foolishly doting on his wife, (e) lovesick.

-oOo-

APPENDIX C

A test of English language (CIEFL, 1980)

SECTION A

(I) Write suitable articles in the blanks in the following sentence

(1) This is _____ worst thing that could have happened

(2) Mr. Sankar is _____ honest man

(II) Write suitable prepositions in the blanks in the following sentences

1. He was born _____the summer _____ 1969.

2. She fell unconscious _____ hearing the shocking news.

(III) Write suitable pronouns in the blanks in the following sentences.

1. The children have gone for a holiday with _____ parents.

2. Is this cycle_____? I've seen you using it.

(IV) Write suitable articles, prepositions or pronouns in the blanks in the following sentences.

1. The children are scared of him because _____ shouts at _____

2. The doctor has advised_____to live _____ fruits alone as he found that she had _____ very bad liver.

3. There are_____number of good films in Hyderbad now. I want to see them all. To do that, I must see them at _____ rate of one a day. Even then, I am afraid I may miss so me _____ them.

(V) Insert suitable articles, prepositions or pronouns wherever necessary in the following sentences

Example: Mt. Everest is the highest peak in the world

1. As there is lot of money in bank thieves are attracted by it.
2. I asked the teacher to explain me the new topic in Science.
3. The Principal wants you to inform as soon as you arrive.
4. Talking about the accident, she said she had seen with own eyes.
5. If you are in need of anything ask it.

SECTION B

(I) Insert the right form of the ver given in brackets into each of the following sentences.

1. He_____(go) there yesterday.
2. She_____(go) to school by bus everday
3. I must_____(meet) the Principal tomorrow.
4. He_____(have) his tea when I _____ (telephone) him yesterday
5. He_____(live) here since 1934.

(II) Put a (-/) mark against all the sentences which are grammatically correct and an (X) mark against those not grammatically correct

1. Last year I walk to school every day. /___/
2. Last year I have walked to school every day /___/
3. Last year I walked toschool every day. /_/
4. Last year I was walk to school every day. /___/
5. Hari did not came to class. /___/
6. Hari has not came to class. /___/
7. Hari has not came to class. /___/
8. Hari does not come to class. /___/
9. Kamal was been swimming since sunrise. /___/
10. Kamal swimming since sunrise. /___/
11. Kamal swims since sunrise. /___/
12. Kamal has been swimming since sunrise /___/

(III) Make questions whose answeres will be the following statements. Use the words given in brackets to begin the questions.

l. The students like science fiction. (what)
2. Hari has broken by glasses. (whose)
3. The children go to school by bus. (How)

SECTION C

(I) Reach each sentence and decide if there is an error in any underlined part. Write the

letter of the wrong part in the box. If there is no error write D. (NE stands for 'NO ERROR')

1. An obiect normally becomes hot when place it
   A B C
   in the sun. (NE) /_____/
   D

2. Ranjit and his sister are studying in same
   A B C
   School. (NE) /_____/
   D

3. Balu and brother came to my house last,
   A B
   night. (NE) /___/
   D
   c

4. She does not know anyone who works in.
   A B
   that office /NE) /_____/
   c D

5. Why did you gave him my book? (NE) / /
   A B C D

6. I did not been able to pay my fees yet. (NE) / /
   A B C D

7. It was difficult for me to hearing the
   A B
   speaker. (NE) /_____/
   C D

8. The Police complain that cyclists seldom
   A B
   observe traffic rules (NE)
   C D /_____/

9. Mother asked to my friends why they
   A B
   Were leaving so soon (NE) /_____/
   C D

10. I still do not understand that how a
    A B
    steam engine works. (NE) /_____/
    C D

11. You will lose your purse unless you are
    A B
    not careful. (NE)
    C D /_____/

12. We searched everywhere but could not
    A B
    anywhere find the watch. (NE) /_/
    C D

13. A friend of her told me that
    A B
    she has passed. (NE) /_____/
    C D

14. The Principal himself must sign
A B
both the copies of the application (NE)
C D/ /

15. I was sure he would join this college
A
although he did not do so. (NE)
D a / /

SECTION D

(I) Select words from the list given to fill in the blanks in the sentences:

List of words:

is	what	who	although
are	when	whom	because
was	where	whose	However
were	which	that	therefore
am	while	so that	but

1. He left the place early _____ he could reach home before sunrise.

2. I thought he would join the college_____ he did not do so.

3. When I telephone him yesterday he told me me_____he_____returning only next week

4. _____ are the candidates _____ are to be interviewed today?

5. He does not have the needed qualifications. _____ he has been given a temporary appointment

6. _____ the rains came late, farmers are hopeful of good crop.

(II) Rewrite the following sentences correcting the mistakes in them

1. He used to laughing at others.

2. How you open this gate?

3. He has left the college in 1978.

4. Can you tell how does it work?

5. Having booking the ticket much in advance, we enjoyed a comfortable journey.

6. The man whom I met him yesterday is the new warden.

SECTION E

Read each passage and the statements that follow it it. Decide whether each statement is true or false, according to the passage, and put a /__ __/ or a / X / in the box.

(I) Rani asked Raju if he wished to own a scooter. He said he did not mind spending seven thousand rupees on buying one. But he could not spend Two hundred rupees a month just for maintaining it.

1. Rani wants to sell a scooter for Rs. 7000/- /___/
2. Raju cannot imagine spending so much money on a scooter. /_____/
3. Raju canafford to pay Ks.7000/- for a scooter. /___/
4. Raju thinks that maintaining a scooter is expensive. /_____/

(II)"No;" said julie's father. "It's not right to keep a dog in a flat in the middle of a big town. Wait for a few weeks. Then we will have our own house with a garden.

5. Julie had asked her father to get a pet dog. /___/
6. Julie's father does not like pet dogs. /____/
7. Julie's family were about to move to a new house. /_____/

(III) When my aunt was young there was no electricity or running water in the house. She used to walk half a mile everyday to fetch water from the village well.

8. My aunt walks half a mile everyday. /____/

9. She does not go to the village well now. /____/

10. She usually fetches water from the well. /____/

(IV) We lived in Hyderbad many years ago. We were there for four years. Then my family moved to Madras. We haven't been to Hyderbad since then.

11. We are now living in Madras. /___/

12. We used to live in Hyderbad. /___/

13. We visited Madras from Huderbad four years ago. /___/

14. We lived in Madras for four years before returning to Hyderbad. ^/___/

15. We haven't visited Hyderbad for many years now. /____/

SECTION F

(I) Read the passage carefully and answer the questions that follow:

The frail man wearing a jibba anddark glasses and carrying a walking stick, was a familiar figure all over India. One day, people returning home from offices in Madras were surprised to find him walking along the road to the Central Railway station just

like an ordinary man. There were suprised looks and excited inquiries. People asked one another, "Why is he walking in this crowd? It could be dangerous,". The man they were talking about was Chakravarhi Rajagopalachar, the Chief Minister of Madras State. When Rajaji, as he was popularly and affectionately known, was asked why he was going to the station on foot, he had a simple answer. He had actually come by car. But the traffic jam near the station had forced the car to stop. He had to reach the station in time, so he had got out of the car and was walking. In any case, he did not see any reason why he should not walk a few steps even though he was the Chief Minister of the State*

1. At what time of day did people see Rajaji walking on the road?

   (a) early in the morning (c) at about 10.00 AM
   (b) late at night (d) at about 5.00 PM

2. What information supports your answer to question 1?

   a) He was carrying a walking stick
   b) He was wearing dark glasses.
   c) The road near the station was crowded.
   4) People were returning home from offices.

3. There were surprised looks and excited enquiries because

   a) it was dangerous for a minister to walk in a crowd.

   b) Rajaji's train might have been delayed

   c) the Chief Minister was walking along the road / /

   d) the crowd had farced the Chief Minister's car to stop but he was facing the situation bravely.

4. Rajaji's reason for walking to the station was that

   a) he believed in simple Gandhian principles.

   b) he thought walking would be more effective in the traffic jam.

   c) his popularity depended on being close to the common man.

   d) the crowd was hostile and he would be safer in the station. / /

5. "In any case, he did not see any reason why he should not walk ..... " This statement indicates that Rajaji felt that ministers should

   a) always walk and set an example. / /

   b) be prepared towalk whenever it seemed necessary.

   c) walk on the steps of buildings, not on the roads.

   d) help prevent traffic jams by not usingbig official cars.

6. Find the word nearest in meaning to the word in capitals which occurs in the passage.

FRAIL : A) fierce b) weak c) important d) simple / /

INQUIRIES: a) rumours b) slogens c) questions d) notices / /

ACTUALLY : a) really b) usually c) earlier d) accidentally / /

APPENDIX D

The form lists of the Form B of Northwestern University Auditory Test No. 6 (NU - 6).

	LIST I	LIST II	LIST III	LIST IV
1.	burn	live	sheep	rose
2.	lot	voice	cause	dog
3.	sub	ton	rat	time
4.	home	learn	bar	such
5.	dime	match	mouse	have
6.	which (with)	chair	talk	mob
7.	keen	deep	hire	bone
8.	yes	pike	search	sail
9.	boat	room	luch	rough
10.	sure	read (read)	cab	dip
11.	hurl	calm	rush	join
12.	door	book	five	check
13.	kite	dab	team	wheat
14.	sell	loaf	pearl	thumb
15.	nag	goal	soup	near
16.	take	shack	half	lease
17.	fall	far	chat	yearn
19.	week	witch	road	kick
20.	death	rot	pole	get
21.	love	pick	phone	lose
22.	tough	fail	life	kill
23.	gap	said	pain	fit
24.	moon	wag	base	judge
25.	choice	haze	mop	should
26.	king	white	mess	pass

27.	size	hush	germ	back
28.	pool	dead	thin	hall
29.	vine	pad	name	bath
30.	chalk	mill	ditch	tire
31.	laud	merge	tell	peg
32.	goose	juice	cool	perch
33.	shout	keg	seize	chain
34.	fat	gin	dodge	make
35.	puff	nice	youth	long
36.	jar	numb	hit	wash
37.	reach	chief	late	food
38.	rag	gaze	jug	mood
39.	mode	young	wire	neat
40.	tip	keep	walk	tape
41.	page	tool	date	ripe
42.	raid	soap	when	hole
43.	raise	hate	ring	gas
44.	bean	turn	check	came
45.	hash	rain	note	vote
46.	limb	shawl	gun	lean
47.	third	bought	beg	red
48.	jail	thought	void	doll
49.	knock	bite	shall	shirt
50.	help	lore	lid	sour
51.	met	south	good	wife

APPENDIX E

Sound pressure levels in the Sound Treated Room at various Frequency Bands.

FREQUENCY	Max. allowable noise levels in dB SPL re:0.0002 dyne/an^2	SPL value in the test room in dB SPL re: 0.0002 dyne/an^2
OCTABE BANDS		
75 - 150 Hz	31	14
150 - 300 Hz	25	18
300 - 600 Hz	26	10
600 -1200 Hz	30	12
1200 -2400 Hz	38	10
2400 -4800 Hz	51	11
4800 -9600 Hz	51	11
C Scale	30	30