DOCUMENT RESUME

ED 098 951 IR 001 330

AUTHOR Levine, S. Joseph
TITLE Listeners' Preferences for Rate of Presentation of Recorded Information.
INSTITUTION Consortium on Auditory Learning Materials for the Handicapped, East Lansing, Mich.; Michigan State Univ., East Lansing. Regional Instructional Materials Center for Handicapped Children and Youth.
PUB DATE Aug 74
NOTE 134p.

EDRS PRICE MF-$0.75 HC-$6.60 PLUS POSTAGE
DESCRIPTORS Aural Learning; *Elementary School Students; Individual Differences; *Listening Comprehension; Literature Reviews; *Phonotape Recordings; Self Pacing Machines; *Special Education; *Speech Compression; Time Factors (Learning)

ABSTRACT

Previous studies show that a listener has the potential to receive recorded information at a rate far exceeding the rates that are used for conversation and for the production of tape recordings. However, few studies have examined listeners' rate preferences. Thus, 48 elementary school children in the 3rd, 4th, and 5th grade listened to a series of four recorded presentations. While listening to each recorded presentation, the subjects were allowed to manipulate the rate of presentation of the recording through the use of a speech compressor. All subjects listened to the same four recorded passages. The results support the following conclusions: (1) children will manipulate the rate of presentation of recorded information in a self-paced listening situation; (2) children demonstrate a preference for a certain rate; and (3) the extent a listener alters the listening rate is positively related to the difference between the initial rate of presentation of recorded information and the listener's manifest preference for rate. As such, instructional materials that are designed for use in a self-paced listening environment will be more likely to be altered by the subject toward a preferred rate when the initial rate of presentation is more different from the listener's preferred rate. (Author/WCM)

Auditory Learning Materials for Special Education

Listeners' Preferences for Rate of Presentation of Recorded Information

Research Report

S. Joseph Levine
Media and Materials Development Unit
Great Lakes Region Special Education Instructional Materials Center
Michigan State University
East Lansing, Michigan

In conjunction with
The Consortium on Auditory Learning Materials for the Handicapped

August 1974

Preface

Inexpensive speech compression/expansion tape playback equipment is soon to become a reality. When this occurs it will be possible for large numbers of school children to take advantage of this technology to better individualize learning through listening. The study that is described in this report establishes that children do have a preference for the rate of presentation of tape recorded material. The study further examines the listening behaviors that can be expected when school children are given the opportunity to individually control the rate of presentation. This study is but a beginning to a long overdue investigation into the many controllable aspects of auditory instruction. Further studies of this nature will assist educators in more effectively using auditory instructional materials with handicapped children.

Ted W. Ward, Coordinator
Consortium on Auditory Learning Materials
for the Handicapped

ABSTRACT

LISTENERS' PREFERENCES FOR THE RATE OF PRESENTATION OF RECORDED INFORMATION

By

S. Joseph Levine

Previous studies show that a listener has the potential to receive recorded information at a rate far exceeding the rates that are used in conversation and for the production of tape recordings. However, few studies have examined listeners' rate preferences. By using an experimental setting that allowed listeners to autonomously manipulate the rate of presentation of recorded information, it was proposed that listeners would manifest a preference for rate of presentation and would demonstrate rate manipulation behaviors that were related to the difference between the initial rate of presentation of the recorded information and the listener's preferred rate.

Forty-eight elementary school children in the third, fourth and fifth grade listened to a series of four recorded presentations. While listening to each recorded presentation, the subjects were allowed to manipulate the rate of presentation of the recording through the use of a speech

compressor. Each of the four presentations began at a different initial presentation rate. All subjects listened to the same four recorded passages. The four initial presentation rates used in the study were 100 words per minute, 150 words per minute, 200 words per minute, and 275 words per minute. The rate manipulation behaviors of each subject were recorded on a strip chart recorder for later analysis.

The results of the analyses of third, fourth and fifth grade subjects' rate manipulation behaviors support the following conclusions:

1. Children will manipulate the rate of presentation of recorded information in a self-paced listening situation.

2. Children demonstrate a preference for rate.

3. The extent a listener alters the listening rate is positively related to the difference between the initial rate of presentation of recorded information and the listener's manifest preference for rate.

The findings suggest a disparity between the rate at which a student is able to listen and the rate at which he prefers to listen to recorded information. This study has also suggested that an initial presentation rate for recorded information that varies greatly from the listener's preferred rate of presentation will stimulate greater rate change than an initial presentation rate that is close to

the listener's preferred rate. As such, instructional materials that are designed for use in a self-paced listening environment will be more likely to be altered by the subject toward a preferred rate when the initial rate of presentation is more different from the listener's preferred rate.

TABLE OF CONTENTS

Rationale of the Study

Background

The differences between communicating through speech and communicating through the printed word have been examined through many studies. A primary difference between the two forms of communication lies in the ability of the receiver to alter the rate at which the communicated information is received. The reader is able to adjust his reading rate to suit his particular reading ability, to suit his mood, to match the difficulty of the material, and to correspond to the necessity of retaining the information that is presented. The listener, however, is dependent upon the rate of presentation of the person delivering the information. This dependency is found in both the face-to-face verbal interchange and in pre-recorded information delivery. In the face-to-face situation the receiver may, however, request the sender to increase or decrease the rate of presentation. This is not possible when listening to recordings. In most cases the reader operates with a self-paced system whereas the listener must utilize an externally paced system.

This study has been designed to examine listening behaviors when the listener is given the opportunity to utilize a self-paced system for adjusting the rate of presentation of recorded information.

Statement of the Problem

The use of compressed speech as a procedure for altering the rate of presentation of recorded material has been shown to be an effective tool for increasing the efficiency of learning through listening. Educators are just beginning to realize the implications of this procedure and schools are starting to provide pre-compressed materials for students. It has been shown that listeners can more than double the rate of presentation of recorded material without a significant decrease in their comprehension. However, it has been assumed that a listener who is provided with a pre-compressed recording will want the recorded material presented at the fastest rate at which he can attend and still comprehend. No study has yet been conducted on the situation in which the listener has autonomous control over the rate of aural presentation. A breakthrough in technology makes this an important question. Speech compressors first became available at a cost of five thousand dollars per unit with added expense necessary for peripheral equipment. This cost dropped drastically in 1973 with the availability of two different units that were priced at fifteen hundred dollars and five hundred dollars.

Finally, in 1974, information was released regarding the availability, within a year, of a speech compressor that would sell for approximately one hundred dollars.

With the advent of inexpensive speech compression equipment that provides for instantaneous playback of rate-altered recordings, many students will be given the opportunity to self-pace the playback of recorded material. The impending availability of this equipment reinforces the need for research that establishes a more complete understanding of self-paced listening behavior. The dream of widespread availability of speech compressors is soon to be realized and there is little information regarding how this equipment will be used.

Purpose of the Study

The primary purpose of this study was to ascertain if listeners, given the opportunity to alter the rate of presentation of recorded material, in fact will alter the rate. Further, if listeners do alter the rate, what rate-altering behaviors will they display? And, is it possible to gather meaningful data regarding rate-altering behavior for elementary school students? Finally, is it possible to determine an individual listener's manifest listening rate preference for recorded information?

Importance of the Study

A review of studies examining the use of compressed speech indicates a primary concern with ascertaining the

upper limits at which a listener can comprehend compressed recorded material without a significant decrease in comprehension. To fully understand the use of compressed speech it is necessary to examine the rate a listener will select for listening to the recorded speech. Such an examination will allow the establishment of groundwork for the definition of the operational limits for training procedures that can be used to develop an individual's listening behavior from the point of preference to the point of maximum efficiency. The point of maximum efficiency is defined as the maximum rate that does not show a significant decrease in comprehension.

It can be expected that inexpensive speech compression equipment will be available for general use within the next year and used on a widespread basis within the next five years. This study attempts to establish a basis for the development of guidelines for effective use of this equipment so that listener selection of rate can become a systematic process based on the individual behaviors of listeners in relation to the potential behaviors of listeners. In 1967 Friedman, Graae, and Orr reported:

> Given the state of current technology, self-pacing is of limited practical value since it is not feasible to make available machines for extensive individual use. However, it may be practical to provide a machine for a school library for individual use as an auditory review mechanism for material with which the student is already familiar. (Friedman et al, 1967, p. 27)

In the seven years since the Friedman, Graae, and Orr study was completed, technological advancements have opened up new frontiers. For the first time, self-pacing will be available and it can be expected to have great practical value. This will bring to fruition the need that Richard Kinney spoke of at the 1966 Louisville Conference on Time Compressed Speech.

> Ultimately, what we need in this field is a device that will give the same options to the auditory reader. A device that will lift him to the plain of the visual reader with all the visual reader's freedom of choice. This could be done, I believe, only through an individual compressor-expansor unit for playing back recorded speech. In other words, a talking book or a tape recorder that contains its own personal compressor-expansor so that the listener could speed up or slow down the speech to which he is listening according to his need just as the visual reader unconsciously does.[1]

Research Questions

The study addresses itself to the basic question of whether or not a listener will express his listening-rate preference by manipulating the rate of presentation of recorded information when given the opportunity to do so. To further specify this question and to provide a set of testable hypotheses, two self-paced listening behaviors will be examined. An experimental procedure was designed

---

[1] Kinney, Richard, "Report on Studies in Speech Compression Conducted in the Spring of 1966 by the Hadley School for the Blind," from Proceedings of the Louisville Conference on Time Compressed Speech (Louisville: University of Louisville, 1967), p. 41.

to permit the examination of these behaviors and the collection of data to analyze relationships between these behaviors and a self-paced listening experience.

Behavior #1 - The listener's manifest listening-rate preference for recorded information. By providing a series of rate altered listening segments, each presented at a different rate, the listener will have an opportunity to alter any or all of the segments to better accommodate his own preference. The study will examine whether or not a manifest preference for rate of presentation does exist, whether or not a listener will alter the rate of presentation to better suit his individual preference, and if it is possible to ascertain what this manifest preference is for individual listeners.

Behavior #2 - The listener's manipulation of rate of presentation. Three variables will be examined to better understand instructional options that may become available when self-paced listening opportunities are provided within the school setting. These three variables are the onset of manipulation of rate (manipulation onset) as compared to the initial rate deviation from manifest preference (difference from preference), the termination of manipulation of rate (manipulation termination) as compared to the difference from preference, and the duration of manipulation of rate (manipulation duration) as compared to the

difference from preference.

The listener will be presented four recorded segments each presented at a different pre-altered rate. For segments that deviate greatly from the manifest preference, it is expected that the onset of the listener's manipulation of the rate would occur early in the listening experience. It is not known whether this deviation from manifest preference would relate predictably to the termination or the duration of the manipulation.

This study examines all three of these variables to determine if relationships exist between the initial rate of presentation and manipulation behaviors.

Hypotheses to be Tested

Based on these questions regarding behaviors that are demonstrated in a self-paced listening situation, the following testable hypotheses were formulated:

Hypothesis #1 A manifest preference for rate of presentation of recorded information will be demonstrated when the listener is given autonomous control over the rate of presentation in a self-paced listening situation.

Hypothesis #2 A negative correlation exists between the elapsed time before manipulation onset and the listener's difference from preference. As the difference from preference increases the manipulation onset will occur sooner in the listening experience.

Hypothesis #3 A correlation exists between the elapsed time before manipulation termination and the listener's difference from preference. The direction of this correlation is not hypothesized.

Hypothesis #4 A correlation exists between manipulation duration and the listener's difference from preference. The direction of this correlation is not hypothesized.

Definition of Terms

The following terms and phrases are used in the description of this study. Definitions for each term and phrase are provided to form a common basis for understanding.

Listener A subject in the study, having no known hearing deficits.

Rate The speed of presentation of recorded material. For this study, rate will be presented in words per minute (wpm). Experiments utilizing compressed speech have variously used "percentage of compression," "percentage of time saved," and "words per minute." Words per minute has been selected as the term to be used due to the expressiveness of the phrase, the immediate clarity of meaning, and the precision of measurement.

> In describing compressed speech, specification in terms of word rate appears to be necessary, and it is probably sufficient. Word rate is probably the most meaningful dimension in terms of cognitive and perceptual processes of the listener.[2]

Compressed Speech Speech that has been accelerated in rate of presentation without a resultant change in pitch from that of the original recording. Though periodic samples of the original recorded material have been deleted, comprehensibility is not affected by the deletions. Usually speech compression is accomplished by processing the recorded material through a "speech compressor."

Expanded Speech Speech that has been slowed down in rate of presentation without a resultant change in pitch from that of the original recording. Though small pause segments are inserted at periodic intervals, comprehensibility is not affected due to the insertions. Usually accomplished by processing the recorded material through a "speech compressor" that is operating in the "expand" mode.

Speech Compressor A specialized device, electronic or electro-mechanical in nature, for altering the rate of tape recordings. The speech compressor periodically deletes small samples of the original recording or adds

---

[2] Foulke, E. and Sticht, T. "A Review of Research on Time Compressed Speech," from Proceedings of the Louisville Conference on Time Compressed Speech (Louisville: University of Louisville, 1967), p. 6.

pause segments to the original recording to affect an altered rate without subsequent changes in the pitch of the original material. Alterations of rate are accomplished through the manipulation of a rate control knob.

Self-pacing A listening situation wherein the listener has autonomous control of the rate of presentation of recorded material. This term is used to differentiate from "external pacing" where the rate of presentation of recorded material is controlled by persons or equipment not in the direct control or influence by the listener.

Chart Recorder An electro-mechanical transducer that inscribes a line on a continuous roll of paper. The paper moves at a known rate and the scriber deflects in response to the subject's function. For this study the chart will provide a documentary record of the rate selections made by the listener.

Manipulation onset The point of time, measured from the beginning of a listening segment, at which the listener begins to alter the rate of presentation (see Figure 1.1 at indicator a).

Manipulation termination The point of time, measured from the beginning of a listening segment, after which no further alterations of rate are made by the listener (see Figure 1.1 at indicator b).

Manipulation uration The elapsed time between the onset of manipulation and the termination of manipulation (see Figure 1.1 at indicator c).

Manifest preference for rate A grouping of final selected rates of a series of listening segments that does not exceed 40 wpm in width. This term is further defined at a later point in this report (see Figure 1.1 at indicator d).

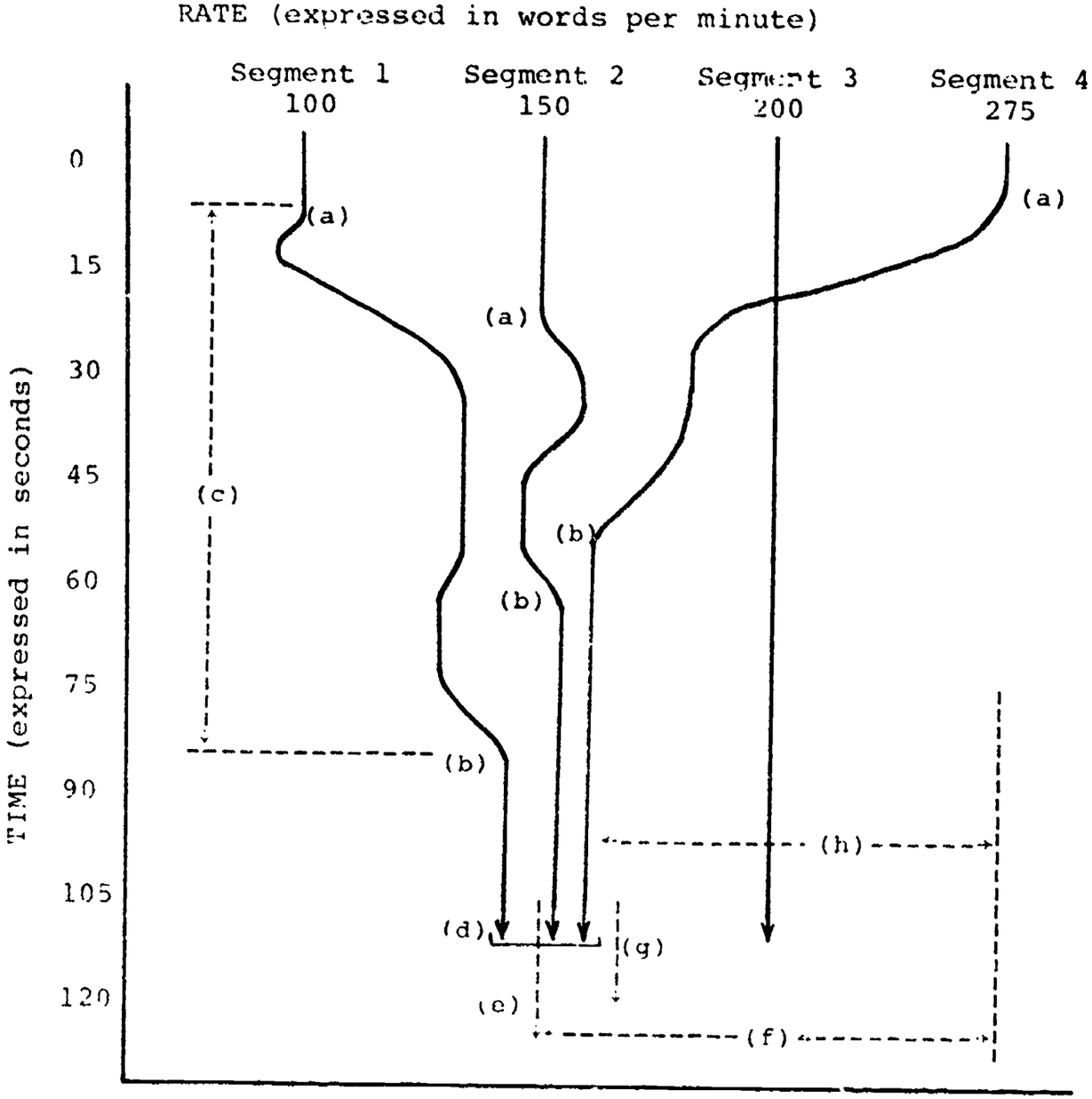
Mean manifest preference rate A single rate computed to denote the mean of the manifest preference for rate. This term is further defined at a later point in this report (see Figure 1.1 at indicator e).

Difference from preference The rate differential between the initial presentation rate of a segment and the mean manifest preference rate (see Figure 1.1 at indicator f).

Point of convergence The arithmetic mean of a subject's final selected rates that has not been altered or adjusted through the use of any of the defined criterion that are described in the "Methods and Procedures" section. This term is used in the discussion of the findings to examine rate manipulation behavior for all subjects without regard for exclusions used to compute mean manifest preference rate (see Figure 1.1 at indicator g).

Extent of Movement The rate differential between the initial presentation rate of a segment and the final selected rate (see Figure 1.1 at indicator h).

HYPOTHETICAL RATE-CHANGING BEHAVIORS FOR A LISTENER



(a) = manipulation onset
(b) = manipulation termination
(c) = manipulation duration (for segment 1)
(d) = manifest preference for rate
(e) = mean manifest preference rate (for three segments)
(f) = difference from preference (for segment 4)
(g) = point of convergence (for all segments)
(h) = extent of movement (for segment 4)

FIGURE 1.1

RELATIONSHIP OF DEFINED TERMS

Review of Related Literature

The review of related literature provides an overview of the entire area of compressed speech research and highlights those studies that have examined listeners' preferences for rate of presentation. Though very few studies have dealt with rate-preference in a self-paced listening situation, the studies that are reviewed form a logical theoretical basis for the study.

The first of the four sections of this review, History and Background, deals with the key experiments in speeded listening (prior to the development of compressed speech techniques) and the first experiments that were concerned with the development of speech compression techniques. The viability of the use of compressed speech as a vehicle for altering the rate of presentation of recorded material without adversely altering comprehension or intelligibility is established. The second section, Comprehension and Rate of Presentation, reviews those studies that have examined rate thresholds for listening; the parameters of rate of compression, especially the probable tolerances for changed

rate, that should be used in a study of listener rate preference are deduced. The third section, Listener Preference for Rate of Presentation, reviews all known research studies that have examined some aspect of listeners' preferences for rate of presentation. The review includes a range of studies wherein listeners were merely questioned as to their rate preference, were provided a finite set of rates to select from, or were provided infinite selection of rates for total self-pacing. The basis of research procedures for the proposed study is deduced from these studies. The fourth section presents Recent Advances in the technology of speech compression.

History and Background

Goldstein (1940) provided one of the earliest investigations into the effect on comprehension of increased rates of presentation of recorded materials. The study of 280 adult subjects with a mean age of 34.3 used both auditory stimulus and visual stimulus. A total of 28 passages were selected, sub-divided equally according to level of difficulty (14 were at a 3.5 grade level and 14 were at a 7.5 grade level). The subjects listened to a record that presented each passage at rates varying from 100 words per minute to 322 words per minute, in increments of 37 words per minute. Though the study was primarily interested in examining differences between reading and listening, the results were the first indications that listeners can process

auditory information at a rate faster than that which is encountered in normal conversation or that which is used for presentation. Goldstein found that comprehension declined as rate was increased; however, the differences between reading comprehension and listening comprehension grew smaller as the rates of both increased. The findings suggested that at faster rates both processes (reading and listening) were equally effective, or more precisely, equally ineffective. A potential source of invalidity in the measurement of listening comprehension in the Goldstein study was due to the pitch increase that accompanied the increased rate of presentation; the recordings were altered in rate by merely speeding up the replay to gain faster words per minute rates, simultaneously increasing the pitch. Later studies show that comprehension does not decline for increased rate listening tasks when original pitch is maintained until a certain rate is achieved (Fairbanks et al 1957b, Bixler et al 1961, Foulke et al 1962, Sticht 1968, Gropper 1969). The pitch change in the Goldstein study is one potential reason why the comprehension of the listening passage declined at faster word rates. Garvey (1953) further points out that the Goldstein study required readers to speak at rates higher than normal when making the recordings for the study. This was done in an attempt to somewhat lessen the effects of pitch change on comprehension. Garvey states that the "method is limited by the rate at which the reader

is able to speak, and also by the changes in enunciation and timing involved in attempting to speak rapidly." (Garvey, 1953, p. 102)

Goldstein's findings were later supported by Fergen (1954) who found that when 438 subjects in grades four, five and six were presented with progressively faster rates (80 wpm, 130 wpm, 180 wpm, and 230 wpm) created by having the reader read faster, that comprehension increased from 80 wpm to 130 wpm, but fell off after 130 wpm. Grumpelt and Rubin (1972), however, found that increased rate with resultant pitch change could show higher comprehension if training at the increased rates were provided for the subjects. In their study, 66 blind high school students were divided into control and experimental groups. Both groups were equated according to age, IQ, and pre-test comprehension of recorded material. The experimental group received listening training at speeds from 275 wpm to 300 wpm while the control group received similar training at only 175 wpm. On a post-test presented at 300 wpm, the experimental group scored significantly higher than the control group, though both groups showed a decline in comprehension from the pre-test. While the training effect was supported as a procedure for improving comprehension, the study indicated that the improvement in the experimental group was still small (9.4%).

In an attempt to control for the effect of pitch change as a contaminant to comprehension of listening to

recorded materials at fast rates, Garvey (1953) utilized a "chop-splice" technique to alter rate without altering pitch. Garvey based his procedure on a study by Miller and Licklider (1950) who found that undistorted speech patterns contain an excess of cues which, though utilized by the listener, are not essential to intelligibility. In their work, Miller and Licklider electronically interrupted the presentation of speech by systematically turning the speech on and off at a desired rate. They reported that at a rate of ten times per second the intelligibility of monosyllabic words did not drop below 90% until over 50% of the original speech pattern had been removed. In this study, however, no attempt was made to close the gaps produced by turning the speech off.

Garvey's study attempted to gather data on the effect of closing this gap and thereby increasing the rate while presenting speech with fewer cues for the listener. Garvey recorded spondaic words (baseball, sunset, etc.) on a specially modified tape recorder that moved the tape at 40 cm. per second instead of the standard 19.5 cm. per second. This procedure yielded a tape record of a word on a longer section of tape than is typical and thereby provided more room for chopping and splicing the tape. Carefully marking the beginning and end of the recorded word, he systematically removed short sections of the tape record at specified intervals in between. The remaining

sections of the tape were spliced together and then transferred to another tape for use in presentation to the subjects.

Garvey studied 96 male college students, randomly assigned in groups of six to 16 different treatment variables. He was concerned with the relationships between intelligibility and a) the general effect of acceleration, b) the size of the chop removed when acceleration was held constant at twice the original speed, and c) the percentage of the speech pattern removed.

Garvey found that a mean intelligibility score of 78% was still obtained when words were presented at 3.0 times the original speed. It was not until the speed was 3.5 times original that intelligibility approached the 50% level. He further found that discrete spondaic words could be presented at 2.5 times original speed with no significant decrease in intelligibility. In terms of the size of the discarded segment, he found that intelligibility is not adversely affected until the discard segment is at least .0625 seconds (2.5 cm.) in length. Finally, comparing speeded rates with and without resultant frequency (pitch) shifts, Garvey found:

> At an acceleration of 1.75, using the same test words and identical experimental procedure, the mean of the intelligibility scores, with the concomitant frequency shift, was 90%; for the same degree of acceleration without frequency shift the mean intelligibility score was 95%. For an acceleration of 2.0, mean intelligibility with the frequency shift was 65%, but was 95% with the "chop-splice" technique.

> When the acceleration was increased to 2.5, a mean intelligibility score of less than 10% was obtained with the frequency shift and a mean intelligibility score of 93% was obtained with the "chop-splice" technique. (Garvey, 1953, p. 106)

This study by Garvey substantiates the usefulness of recorded material that is presented at rates faster than "normal" if altered to compensate for pitch change. The Garvey study, however, is limited in direct application to the general field of rate of listening since spondaic words, rather than connected discourse, formed the basis of the listening experience.

Fairbanks, Everitt, and Jaeger (1954) reported the development of an electro-mechanical device that would allow the automation of Garvey's chop-splice procedure. The Vari-Vox utilized a set of four heads mounted on a cylinder that rotated as the tape passed. One and only one of the four "pickup" heads was in contact with the tape at any time. However, at the point when one head left contact with the tape and the next head began contact with the tape a short portion of the passing tape was not reproduced. In this manner, it was possible to remove short segments of recorded information. The output of the Vari-Vox was fed into another tape recorder for generating a permanent taped record of the "compressed" version of the original tape recording. The development of this electro-mechanical device for speech compression presented the first practical procedure for compressing large segments of recorded information and allowing

future studies to examine larger units of verbal information (connected discourse) rather than the small units examined in the earlier studies. Further, it permitted a viable procedure for speeding up recorded information without resultant changes in pitch which have been shown to adversely affect comprehension and intelligibility.

Fairbanks, Guttman, and Miron (1957a, 1957b) conducted studies that examined comprehension as a function of word rate and the use of "saved" time due to speech compression to re-present the recorded material. In their studies, it was found that there was little difference in comprehension of recorded material presented at 141 wpm, 201 wpm, and 282 wpm. Also, when the rate of presentation was doubled (from 141 wpm to 282 wpm) and the material was presented twice, comprehension for subjects who listened twice was better than for subjects who were only allowed a single presentation at 141 wpm. Both groups of subjects required the same amount of time for the listening task.

By the late 1950's, the examination of speech compression as a technique for presentation of recorded information at increased rates was established as a viable topic for researchers. Research had shown that it was possible to comprehend material presented at rates faster than normal, the procedure of increasing rate without affecting pitch was superior for learning as compared to procedures that distorted pitch, and equipment was finally available that

allowed the researcher a convenient procedure for compressing recorded material.

Comprehension and Rate of Presentation

The studies reviewed examine the listening rate in comparison with comprehension. The purpose of this section is to provide an understanding of the studies that have investigated the optimization of the speech compression process in terms of most effective and/or most efficient listening rates. In all of the studies reported, an externally paced listening experience has been used. Some of the studies first presented, however, attempted to answer the question of rate preference without using self-pacing procedures by asking the subjects to state or choose their preferred rate. Through an examination of the studies, it is possible to ascertain the appropriate range of presentation rates for utilization in this study.

Prior to the use of speech compression as a technique for increasing rate of presentation, a few studies examined the effect on comprehension due to increased rate that was effected through non-machine procedures.

Nelson (1948) chose to study radio broadcasts and the effect of rate of presentation on comprehension as measured by recall. Five different newscasters each recorded five different newscasts at five different rates that varied from 125 wpm to 225 wpm in increments of 25 wpm. Though

Nelson found a decrease in comprehension from 125 wpm to 225 wpm, this decrease was not found to be significant. No preference was shown for any single announcer that was used in the study and an analysis of reactions indicated a preference for a rate between 175 wpm and 200 wpm. Nelson used this last finding to hypothesize that:

> The slight increase in mean scores between 175 and 200 words-per-minute (13.70 to 13.94) might indicate that the most "efficient" rate as measured by student reaction might be somewhere between 175 and 200 words-per-minute. (Nelson, 1948, p. 179)

Harwood (1955) supported the earlier findings of Goldstein (1940) and Nelson (1948) when he found that listenability (listening comprehension score) decreased as rate of presentation increased. For this study, Harwood used a single male voice to create separate recordings at each rate. The speaker altered his rate of speaking to match the word rates needed for the study. No electro-mechanical procedure for increasing word rate was used. Harwood also found that mean listenability, the mean of listening comprehension scores, at each of four rates of presentation (125 wpm, 150 wpm, 175 wpm, and 200 wpm) did not show significant differences that favored any specific word rate. This study did show significant findings that supported "readability," as defined by Flesch, as an indicator of "listenability." As such, Harwood suggested the use of readability as a gross predictor of listenability.

Diehl, White, and Burk (1959) inquired into the relationship of rate of speech and listener comprehension by altering only pause time. A master tape was produced with spoken discourse that was presented at a rate of 145 wpm. Four modified versions of this tape were then created. Tape A had 75% of each individual pause removed thereby creating a tape with a word rate of 172 wpm. Tape B had 50% of pause time removed and resulted in a new speed of 160 wpm. Tape C had the pause time increased by 75% which slowed the rate to 135 wpm. Tape D had the pause time increased by 50% which slowed the rate to 126 wpm.[1] Tape E was not changed and was presented at the original rate of 145 wpm. A total of 371 college students listened to both a comprehension test and a reaction rating scale. An analysis of the data on comprehension showed no significant differences in comprehension for any of the five different word rates. The responses to the subjective rating scale also failed to yield significant differences with all five tapes rated as "good" to "very good" in terms of delivery to the speaker. The findings indicated conflict with Nelson (1948) in that no rate, or rate range, was generally preferred. It was pointed out, however, that such a conflict was dependent upon the comparability of this study's use of the word "good" and Nelson's use of the

---

[1] The percentages and word per minute rates are shown exactly as reported in the Diehl et al article. It is assumed that there is an error in the percentages at the 135 wpm and 126 wpm rates. The procedure would be more consistent if "50%" and "75%" were reversed.

word "interest." Nelson asked the subjects to respond in terms of their interest in the presentation at the different rates while Diehl et al asked the subjects to rate the delivery on a scale from very good to very poor.

Fairbanks, Guttman, and Miron (1957b) analyzed the use of speech compression techniques and their resultant effects on comprehension of connected discourse. Technical information was recorded and compressed at a number of different rates up to 70% compression (30% of original recording time). At 50% compression (50% of original recording time, 282 wpm) response to a factual test was almost 90% of maximum. However, at 60% compression (40% of original recording time, 353 wpm) response fell to 50% of maximum. This pioneering study in the examination of externally paced compressed presentations indicates that rates of at least 282 wpm are possible without significant loss of comprehension. It should be noted that the Fairbanks, Guttman, and Miron study was one of the first to examine connected discourse rather than single word presentations. As such, it was possible to examine comprehension effects rather than merely examinations of intelligibility as were previously reported in discrete word studies.

In a study by Bixler, Foulke, Amster and Nolan (1961), 299 blind children from sixth, seventh, and eighth grades were provided compressed listening materials at 175 wpm, 225 wpm, 275 wpm, 325 wpm, and 375 wpm. Materials of

both a scientific nature and a literary nature were used and subject's comprehension was measured for both types of material at the five different rates. No significant loss in comprehension was shown for the literary material at 225 wpm and for the scientific material, comprehension held up at 275 wpm with no significant loss.

Foulke et al (1962) also studied the effects of word rate of compressed material on comprehension. Word rates of 175 wpm, 225 wpm, 275 wpm, and 325 wpm (similar to the Bixler et al study, except omitting the 375 wpm rate) were used with blind subjects in grades six, seven, and eight (same as Bixler). Results of the study indicated that for both literary and scientific passages, a rate of 275 wpm yielded better than 90% comprehension.

Orr, Friedman, and Williams (1965) conducted a study of the effects of training in listening to compressed speech as it effects comprehension. The subjects showed significant differences, in favor of a training effect, when a rate of 425 wpm was reached. However, no significant difference was found at rates of 175 wpm, 325 wpm, and 375 wpm. Those subjects that received no training showed only a 20% decline in performance at more than double the normal speaking rate. This finding supports the previous work of Fairbanks et al (1957b) and Bixler et al (1961) and lead the authors to state that "even without practice, it appears that normal rates of spoken material could be essentially doubled with little or

no loss in comprehension." (Orr et al, 1965, p. 152)

Wood (1965) compressed a group of fifty imperative sentences at rates from 175 wpm to 400 wpm in increments of 25 wpm and presented them in a controlled manner to 90 subjects from the first, third, and fifth grade levels. His findings supported other studies; generally comprehension decreased as rate of presentation increased. For the first-grade group, comprehension at rates above 250 wpm was considerably lower than that for the third and fifth grade groups. Interestingly, the subjects exceeded a 90% comprehension level at rates as high as 350 wpm, and at no rate was the level of comprehension less than 75%. Intelligence was not found to be a statistically significant factor.

A possible explanation for the high levels of comprehension at the high presentation rates (350 wpm) lies in the fact that discrete sentences were used in this experiment as compared to extended narratives comprised of continuous discourse as have been used in most other experiments. This seems to indicate a need for more mental processing time for comprehending continuous discourse than for discrete sentences.

An interesting study by Spicker (1968) compared listening comprehension and retention of "normal" and retarded children. Forty-four subjects of each classification were selected for the study by matching them according to mental age (10.0 to 11.0). Three separate passages differing in

readability levels were presented at 125 wpm (expanded), 175 wpm (normal), 225 wpm (compressed), and 275 wpm (compressed). Data showed no significant differences between groups for listening comprehension and comprehension losses. For the retarded group, comprehension losses were negligible at 125 wpm and greatest at 175 wpm. Conversely, the "normal" group showed the greatest comprehension losses at 125 wpm and least at 175 wpm. This study tends to support normal or below normal rates of presentation for subjects with a mental age of 10.0 to 11.0.

Working with men of high, average, and low mental abilities, Sticht (1968) found that a message can be time compressed by as much as 36% (275 wpm) without greatly disturbing comprehension. For all three groups, comprehension declined only slightly until a rate of 275 wpm was reached and then comprehension declined more rapidly. Sticht states that these results are consistent with previous observations and goes on to say:

> There appears to be some special significance attached to a speech rate of 275-300 wpm such that exceeding this rate accelerates a decline in comprehension. This rate appears to be that at which channel capacity begins to be exceeded. (Sticht, Thomas G., 1968, p. 250)

In an examination of comprehension as a function of listening rate, Gropper (1969) presented narrative passages at 126 wpm, 190 wpm, 252 wpm, 312 wpm, and 380 wpm to 72 fourth-grade subjects. As was shown in early studies, Gropper confirmed that performance on criterion tests

decreased as speed (rate) increased. Significance for this decrease, however, was found only after the speed exceeded 252 wpm. When examining the data in terms of efficiency (learning per unit of time) the 252 wpm rate was the most efficient. Of particular interest to the present study was Gropper's finding that:

> Large individual differences were obtained indicating that there is not one most efficient speed for everyone. In most cases, however, a speed much slower than normal will not add much to comprehension, while speeds about twice as fast as normal will take too much away from comprehension to warrant their use. (Gropper, Robert L., 1971, p. 252)

Two other studies, though not directly related to comprehension as a function of rate, further establish guidelines for the present study. Durrell (1969) compared listening comprehension and reading comprehension. Durrell examined vocabulary and found that, in terms of comprehension of vocabulary words, listening vocabulary is much superior to reading vocabulary in all primary grades. For the third grade, the reading-listening ratio was found to be 76 (listening score was 46 as compared to a reading score of 35). At the fourth grade level the ratio was 83% and at the fifth grade, listening was still superior with a ratio of 90%.

When a comparison of paragraphs was made (longer units of language than separate words as reported above), the differences decreased slightly but listening was still superior for third, fourth, and fifth graders (82%, 83%,

and 95% respectively).

> From grade six on, the scores on reading paragraphs are higher than those in listening. Several factors may account for this superiority in reading to listening: silent reading speed at these levels is greater than the speed of speech, hence more time is available for "looking back" to check comprehension; many words are introduced in silent reading that may not be in listening vocabularies. (Durrell, 1969, p. 458)

When the raw scores of listening tests were equated to a reading grade, Durrell found that the third grade students were operating one year and one month higher in listening than reading (4.6 for listening, 3.5 for reading), nine months higher for the fourth grade (5.4 for listening, 4.5 for reading), and seven months higher for the fifth grade (6.2 for listening, 5.5 for reading). These findings indicate that listening, when compared to reading, is a superior form of communication for third, fourth, and fifth grade students.

In a study that examined the effects of compressing recorded material and then returning it to normal, Sticht (1970) found that:

> Expanding previously compressed materials to restore the word rate to normal may restore the comprehension of the material to very near normal -- when the comprehension/expansion is limited to 40%. When the materials are compressed/expanded by 47%, there is apparently enough noise and/or signal distortion added to reduce comprehensibility of the material significantly below normal, although the restoration of a normal word rate appears to improve the comprehensibility of the material to a limited degree. (Sticht, 1970, p. 107)

Sticht's findings are important since the present

study utilized the speech compressor twice. The recorded material was first pre-altered to specified rates. Then the subject again altered the word rate of the recording during the self-paced listening experience. Sticht's findings establish the fact that such double-alterings of word rate do not adversely affect comprehension as long as the amount of variance does not exceed a difference of approximately 40% compression of the original material.

Listener Preference for Rate of Presentation

Few studies have been conducted that examine listener preference for rate of presentation of recorded material. A predominant contaminant to the larger percentage of those few studies that have been conducted is the dependence on the subject's statement of preference based on a series of presentations at pre-fixed (externally paced) rates. This section reviews all reported studies of listener rate preference that utilized external pacing. The one reported study that utilized self-pacing is also reviewed and discussed in special reference to the design of the present study.

Faulke (1965) sent out invitations to two hundred blind persons registered with Recording for the Blind encouraging them to participate in a research study. Of the two hundred invited, one hundred accepted the invitation. A vinyl record was sent to each person accepting. The record included samples recorded at different rates of

presentation through speech compression procedures. One sample began at a normal rate and gradually increased to 350 wpm. Accompanying the record was a questionnaire designed to assess the listener's reaction to the samples.

Fifty-one percent of the listeners returned the completed questionnaire. Of those responding, 91.7% said that they would listen to material prepared in this manner if it were available. When asked which rate they found "most satisfactory," 45% indicated 275 wpm, 25% indicated 225 wpm, 22.5% indicated 300 wpm, and 7.5% indicated 350 wpm.

In terms of those responding, 275 wpm seems to be clearly indicated as a rate preference in this study. The generalizability of these findings, however, must consider that all respondents were blind (indicating prior experience with learning by listening), all respondents utilized the services of Recording for the Blind which specializes in textbooks rather than light reading (suggesting persons who may typically listen to a larger number of technical recordings than the average blind listener), and the largest percentage of respondents were students, with college students being most numerous (suggesting a respondent group that is highly dependent on listening as a vehicle for information input). Only 10.4% of the respondents indicated that they "rarely" did their reading by means of recordings.

In a study conducted by Foulke and Sticht (1966),

one hundred sighted college students were presented with five listening segments where the speed gradually ascended and five segments where the speed gradually descended. The subjects were instructed to tell the examiner to speed up (slow down) the rate of presentation until a preferred rate was achieved. The mean preferred word rate for the total group was 207 wpm. Males indicated a mean rate preference of 212 wpm and the mean preference rate for females was 204 wpm. The descending trials produced a higher mean preferred rate (217 wpm) than the ascending trials (197 wpm). No attempt was made to measure comprehension.

A second part of the study failed to show any relationship between preferred listening rate and anxiety as measured by the Taylor Manifest Anxiety Scale.

As compared with Foulke's earlier study (1965) the sighted subjects seemed to prefer a rate of presentation lower than preferred by the blind subjects. This preferred rate differential might have been further exaggerated if, instead of using a recording with an eighth grade level in the 1966 study, a recording of college level had been selected. A college level recording would have better matched the level of the subjects in the experiment and may have altered the results.

This study is the first to indicate a difference may exist between preferred listening rate and potential listening rate. Though not conducted in a self-paced manner (the

experimenters controlled the rate according to the preferences verbalized by the subjects), the subjects in this study indicated a mean preferred rate (207 wpm) that is greatly different from the potential rates substantiated in earlier studies (250 wpm - 300 wpm) at which comprehension can still be maintained. This gap between preferred rate and potential rate is not seen in the earlier study by Foulke (1965) which examined blind listeners. The subjects in this earlier study indicated a preferred rate that is very similar to their potential rate (275 wpm was indicated as preferred by the blind listeners). The assumption is that the blind listeners, reported in the study, prefer to listen at a rate closer to their potential rate and consequently are capable of operating at a more efficient level in a listening situation.

In a recent study by Challis (1973), 96 college junior and senior students were randomly assigned to one of four groups: normal rate (120 wpm), 30% compression (174 wpm), 40% compression (200 wpm), and a choice of 20%, 25%, 30%, 40%, 50%, or 55% compression. All subjects received the recorded information in conjunction with filmstrips. No significant difference was found between any of the groups on measures of achievement. Further, there was no interaction between achievement and amount of time spent listening. A questionnaire completed by all subjects at the end of the experiment indicated that 97% felt that learner control over

the compression rate was necessary or desirable for a most satisfactory learning experience. This finding is rather unique in this experiment since only 25% of the subjects were allowed control over the rate of presentation and this control amounted to a forced selection from a small set of choices (six). Such a finding may indicate an ability on the part of the subjects, especially the 75% who were not allowed to select the rate of presentation, to sense a poor individual match between presentation rate and preferred rate. For the 25% who were allowed to select their own rate of presentation, such a finding would seem appropriate. This study implies that a listener does have a rate preference, and that it is possible for a listener to be aware of his own rate match (whether the rate of presentation is the same as that which he prefers) in situations where he is provided a rate choice and in situations where no rate choice is allowed.

Friedman, Graae, and Orr (1967) conducted a series of studies that includes the only documentation to date of a study that examines learner preferences for rate of presentation of recorded information through a self-paced listening environment. The series of studies aimed chiefly at the determination of the ability of college students to comprehend and to be trained to comprehend compressed speech. The two questions asked in the self-pacing study were: 1) At what rate will a listener choose to hear material

which is compressed? and 2) In what way will this affect his learning to comprehend compressed speech?

Based on evidence that suggests that for young children listening is a preferred modality and for older children and adults reading is preferred, the experimenters felt that a potential explanation related to the reader's ability to peruse material at his own rate. This would include speeding up the rate, slowing down the rate, or re-reading difficult portions a second or third time. In other words, when a person is old enough to read, reading is preferred since it accommodates the individual. It was further felt, however, that listening could be considered more informative than reading since it contained intonational nuances. If the provision of a self-paced listening environment could accommodate for the comparative advantages of reading (except for the advantage of re-reading) it was hypothesized that self-pacing would provide a more efficient means of communicating to a subject as measured by the subject's ability to answer questions accurately per unit time taken to receive the information. Additional questions that were examined in the study included: What behavior would result from listener controlled speech? How frequently would the rate be changed? What mean rate would be chosen?

Twelve male college students with a mean age of 19.6 were paid $1.50 per hour for their participation in the study. A $10 bonus for the best subject was promised. The

listening materials consisted of seven historical passages taken from a college level textbook. They were recorded and compressed to 1.5 times their original rate of 175 wpm. The compressed rate was 262 wpm. Comprehension was measured by a group of five option multiple choice questions for each passage.

A baseline passage at normal speed (175 wpm) was administered to all subjects at the beginning of the experiment. The presentation of the remaining passages began with an externally paced compressed passage (1.5 times original), then moved to three self-paced passages, and ended with two more externally paced passages (1.5 times original).

Each subject served as his own control and participated individually during the experiment. For the self-paced passages subjects were provided an unmarked remote control knob that was fixed to the speech compressor and provided control of the rate of presentation. The experimenter recorded selected rates by noting positions of the dial indicator on the speech compressor. Timings were made with stop watches. Subjects were told that not only comprehension would be examined, but they also should try to listen at the greatest speeds.

The lowest mean rate used by any subject on the self-paced task was 1.16 times normal rate and the highest rate was 2.05 times normal. The overall mean speed used by

all 12 subjects on the self-paced task was 1.45 times normal rate. No consistent trend was seen from the first to the third self-paced passage in terms of rate at which they were played. (Means were 1.43, 1.45, and 1.48.) There was a tendency for the number of downward changes in rate to increase and upward changes to decrease as the passage went on. There was no indication of superiority in terms of comprehension of one type of pacing over the other.

In their discussion, the experimenters make note of the fact that the mean rate of each of the self-paced passages was very close to the rate at which they first heard compressed speech (1.5 times normal rate). It was felt that this was due to a modeling effect of the first passage and created a situation whereby the subjects did not want to deviate very far from the model. The subjects tended to increase the rate higher and higher during the first quarter of the self-paced passages and showed more downward rate changes in each successive quarter.

The experimenters pointed out three aspects of the study that may have impeded an increase in comprehension on the self-paced passages as had been hypothesized.

1) The training effect of the series of passages might have contaminated comprehension scores. If the final two passages were self-paced (rather than externally paced) higher comprehension scores might have resulted. The subjects' comprehension might have been negatively affected

due to the pre-set rate that was used for presentation for the final two passages.

2) Since no feedback was provided the subjects at the conclusion of each of the listening passages regarding their comprehension performance, subjects may have been attempting to manipulate the self-pacing to their advantage (to improve their comprehension) but in fact were doing it to their disadvantage (interfering with their comprehension).

3) The mechanics of manipulating the rate may have interfered with passage comprehension. The task of comprehending might have become secondary to the task of manipulating the rate.

Suggestions for further experimentation included experiments a) to provide more practice in self-pacing, b) to control the order of self-paced and external-paced passages, c) to test the effect of feedback on subject performance, and d) to compare active and passive subjects in a self-pacing situation.

This study by Friedman, Graae, and Orr sets the stage for further studies of self-pacing listening behavior. It is certainly easy to criticize experimenters for confounding the experimental conditions by mixing the types of pacing within the experimental procedure if viewed entirely from a position of self-pacing. However, the design seems reasonable if viewed in light of the expressed goal of investigating training effects. As a study of self-pacing,

it falls short; but in terms of training, it yields valuable information on the effect of modeling rates of presentation and confounding comprehension by focusing attention on manipulation of rate.

The instrumentation used in the experiment is a cause of concern since all data were collected through human observation of displayed rate and elapsed times during the actual experiment. A procedure for systematically recording experimental events through a mechanical system would have provided more reliable data. Though two experimenters were used to record data, each was responsible for different sets of data and no reliability checks of the recorded data were reported.

The findings indicate that it is possible for a subject to respond to a set of self-paced situations with preferred listening rates that are similar for all of the situations. Two potential reasons for this behavior are the effect of the initial rate model and the fact that subjects were instructed to return their rate selector knob to the "normal" rate (1.5. times normal) at the beginning of each passage. A procedure to control for the potential biases created by these two constraints would be to present no model prior to the self-pacing activity and to begin each self-pacing passage at a different rate. The subject would be instructed to return the rate selector knob to a zero point prior to the beginning of each passage. This zero point

would be arbitrary and would serve to guarantee that each presentation to the listener would begin at a known rate that is different for each passage.

It should be assumed that a dual focus for the subject (manipulation and comprehension) interferes in unknown ways with the listening task. If a subject is given the dual task of manipulating the rate of presentation and also listening for comprehension, he may either subvert the comprehension task in favor of the manipulation task, or subvert the manipulation task in favor of the comprehension task. By removing the comprehension task from the listening experience, it may be possible to better focus on rate manipulations that accompany self-paced listening experiences. Interference of these tasks demands that they be examined separately before proceeding with studies that look at the interaction.

Recent Advances

The most recent advance in the area of compressed speech was announced in January 1974 when Cambridge Research and Development Group released details of licensing agreements with the world's first and second largest manufacturers of tape recorders for production of tape recorders that included a Variable Speech Control (VSC).

> Variable Speech Control uses miniaturized circuitry smaller than a pocket-sized cigarette lighter to electronically speed up or slow down recorded speech without distortion. The solid-state system

> can be adapted my manufacturers to any standard cassette recorder. A simple knob on VSC-equipped players enables the user to increase the play-back speed to more than twice its original speed without any distortion. Any pre-recorded material can be used. (Cambridge Research and Development Group, Press Release, January 1974, p. 2)

Estimated costs for recorders equipped with VSC are expected to add less than $50 per unit retail to the price of standard audio equipment.

Arthur Fisher, writing in the "Science Newsfront" column of Popular Science says that eventually "the price differential may come down to as little as $10 or $12." An indication of potential demand for such a unit and consequently the expected widespread use was provided by Fisher when he wrote:

> The most provocative Science Newsfront item to appear in the last few years -- judging by reader mail -- did not concern any breathtaking advance in energy generation, environmental control, insight into the nature of the cosmos, or anything else I would have suggested. Instead, it dealt with an electronic method of speeding up or slowing down speech on ordinary cassette players, using tiny integrated-circuit chips of relatively low cost. (Fisher, Arthur, "Science Newsfront," Popular Science, Vol. 204, No. 4, April 1974, p. 30)

Methods and Procedures

The discussion of methods and procedures is divided into four sections. The first section will define the population and sample that was used in the study, the second section outlines the treatment that was implemented to elicit listening behaviors of a self-paced nature, instrumentation and data collection makes up the third section and describes the unique equipment that was utilized for the listening environment and documentation of behaviors, and the final section describes the procedures that were used for data analysis.

Population and Sample

The population for the study comprised elementary school children in grades three, four, and five who displayed no hearing deficits. Children were limited to those attending regular public school classes (not enrolled in special education programs). The delimitation to regular school classes was provided to reduce the likelihood of atypical listening behavior that might have been attributed to a handicapping condition.

sample of 16 subjects from each grade level

(total sample of 48 subjects) was selected for participation in the study. Selection was made on a random basis by the experimenter from enrollment lists for each grade level of a local elementary school. The elementary school was located in an established area of East Lansing, Michigan. The children came from a middle to high socio-economic background with a high percentage of the parents employed in professional capacities. The selection of the sample allowed comparisons across grade levels and also permitted randomization of presentation sequence across subjects.

Each of the 16 subjects for each grade level was randomly assigned to one of 12 different treatments. The conditions of the assignment were the following: 1) no more than two subjects were assigned to any one treatment, and 2) all 12 treatments were assigned.

Treatments

One at a time, each subject in the study listened through headphones to a series of pre-recorded and rate-altered listening selections. Each subject listened to the material in the same room, located adjacent to the school library. The room, approximately eight feet by ten feet, was well lighted and contained a ventilating fan to circulate air within the room.

During the listening experience the subject was given the opportunity to alter the rate of presentation of

the recorded material by manipulating a single rate control knob on a metal box. The metal box had a plain appearance and was constructed so as to provide a minimal distraction to the subject. All instructions regarding the listening experience and actions to be taken by the subject during the listening experience were delivered on the tape and thereby standardized for all subjects. A tapescript of the instructions is provided in Appendix A. The experimenter, the speech compressor, and the chart recorder were situated in the same room as the subject but out of the subject's direct line of sight.

Figure 3.1 presents a schematic diagram that outlines the order of events that were presented on the tape recording.

Introductory Instructions
First Listening Segment
Instructions for Second Segment
Second Listening Segment
Instructions for Third Segment
Third Listening Segment
Instructions for Fourth Segment
Fourth Listening Segment

FIGURE 3.1

ORDER OF EVENTS PRESENTED ON RECORDING

The four listening segments consisted of the first, second, third, and fourth quarters of a single tape recording. This insured a similarity of content and style of presentation for all segments. The instructions, presented prior to each segment, were recorded using a "second voice" which was different than the voice used for the story narration. This served as a form of audio highlighting to cue the listener that, in contrast to the story narration, instructions were now being presented. Or, after listening to instructions, the story narration was being presented or continued.

The story used in the study was selected from the third grade volume of the reading series produced by the Houghton Mifflin Company. The particular story selected was entitled "The Train That Never Came Back" and was written by Freeman Hubbard. This selection was made based on the criteria that a) the story must be from a recognized text that is widely used in the school setting, yet is not familiar to the sample of subjects that participated in the study, and b) the story must use primarily a narrative format rather than a format that contains extensive conversational dialogue. Only those stories were considered that did not exceed the reading ability of the youngest subjects (third grade) as equated to listening ability according to Durrell (1969).

A set of four pictures were created to illustrate

each of the four segments of the story. These pictures, water colors mounted in a flip book, were presented to each subject at the conclusion of the recorded introduction and directly prior to presentation of the first listening segment. The flip book was constructed as an easel and was positioned directly in front and slightly to the left of the remote control unit. Instructions on the tape told the subject when to change pictures. All subjects were observed during the introductory instructions to assess which hand would be used to manipulate the rate control knob. In one case the subject used his left hand and the flip book was then positioned in front of the control unit and to the right of it.

It was felt that a totally "pure" listening experience, one that is devoid of any planned visual stimuli, would be an unnatural listening environment for elementary grade students. Consequently, it could be expected that students, without a provided visual focal point, would visually search the environment to seek for visual input. The providing of the four pictures was designed to control for the effects of extraneous visual stimulation and to control the type and amount of visual stimulation for all subjects. By limiting the number of pictures to one per segment, the motor activity associated with changing pictures was restricted to the interval of time between listening segments and did not disrupt the listening environment. The single pictures were

also felt to provide a level of visual stimulation which would not impede the auditory task.

A tape recording of the story was made by a professional announcer. This recording was then divided into four segments of approximately equal length that matched appropriate break points in the story line. Table 3.1 shows the length and original word rate of each story segment.

TABLE 3.1

LENGTH AND ORIGINAL WORD RATE OF STORY SEGMENTS

Segment	Length (words)	Original Word Rate (wpm)
1	444	191.7
2	492	189.2
3	503	184.0
4	450	179.2

All four segments of the tape were rate-altered to provide a consistent stimulus to each subject. To control for presentation order of the segments, a set of twelve different stimulus tapes were recorded from the original tapes. The segments appeared sequentially in the correct order, but the sequence of rate alterations were varied. The four rate alterations that were used in the study were an expanded rate (100 wpm), a "normal" rate (150 wpm), a moderately

compressed rate (200 wpm), and a highly compressed rate (275 wpm).

In selecting the configurations of sequence for the twelve different stimulus tapes, it was decided to eliminate:

a) any configuration that began with the "normal" rate. This exception is based on the Friedman et al finding that a modeling effect occurred due to the initial presentation rate of 150 wpm. To eliminate the possibility of modeling the normal rate for the subjects, none of the twelve stimulus tapes began at the normal (150 wpm) rate.

b) any configuration that began with the highly compressed rate. Since none of the subjects had prior experience with compressed speech it was assumed that a configuration that began with the highly compressed rate could "overpower" the subject and affect the subject's rate alterations in successive segments.

All configurations of sequence, therefore, began with either the expanded rate (100 wpm) or the moderately compressed rate (200 wpm). The twelve configurations, stimulus tapes, comprised all combinations of the four different rates with the exception of those that began with the normal rate (150 wpm) or the highly compressed rate (275 wpm). Table 3.2 shows the sequence of presentation rates for each of the stimulus tapes.

TABLE 3.2

CONFIGURATIONS OF STIMULUS TAPES

Stimulus Tape #	Segment One	Segment Two	Segment Three	Segment Four
1	M	E	N	H
2	M	N	E	H
3	M	H	N	E
4	M	N	H	E
5	M	E	H	N
6	M	H	E	N
7	E	N	H	M
8	E	N	M	H
9	E	H	N	M
10	E	H	M	N
11	E	M	N	H
12	E	M	H	N

E = Expanded Rate (100 wpm)

M = Moderately Compressed Rate (200 wpm)

N = Normal Rate (150 wpm)

H = Highly Compressed Rate (275 wpm)

Each segment of each stimulus tape was pre-altered to the four selected initial presentation rates. Duration and rate for each segment, in the pre-altered form, are shown in Table 3.3.

TABLE 3.3

DURATION AND LENGTH OF PRE-ALTERED SEGMENTS

Segment #	Length (words)	Duration (seconds)			
		100 wpm	150 wpm	200 wpm	275 wpm
1	444	266	178	133	97
2	492	295	197	148	107
3	503	302	201	151	110
4	450	270	180	135	98

The duration of the actual listening experience was different for each subject since duration was dependent upon the rate manipulations initiated by each individual subject. The total listening experience, including the pre-recorded instructions, lasted no longer than twenty minutes for any subject.

Instrumentation and Data Collection

The instrumentation for the study consisted of three separate pieces of equipment. The subject was only aware of one of the pieces of equipment (the remote control

unit). The other two pieces of equipment (the speech compressor and the chart recorder) were placed out of view of the subject. The only other instrumentation used was a single set of high quality headphones through which the subject listened to the stimulus tape and the picture flip book to accompany the tape.

The remote control unit was a metal box that provided the following functions at a location away from the speech compressor and chart recorder: a) rate control knob, b) volume control to adjust volume to headphones, c) phone jack for connecting headphones, and d) power switch for activating the system and begin presentation of the stimulus tape. The rate control knob included a "zero point" indicated by an arrow on the knob and a corresponding arrow on the body of the case. This "zero point" established the beginning rate that the subject used to start each segment of the story. Instructions to return the knob to this "zero point" were provided in the instructions directly prior to each segment of the stimulus tape.

The remote control unit was placed on a desk of the appropriate height for the subjects. No other materials, other than the picture flip book, were located on the table, thereby minimizing extraneous stimuli.

The speech compressor used in the study was the Varispeech I produced by Lexicon, Inc. This compressor unit is capable of both expansion and compression of recordings

through the manipulation of a single control. With the control set to normal, rotation in a counter-clockwise direction expands the recording (slows down the rate) and rotation in a clockwise direction compresses the recording (increases the rate). A closed circuit jack assembly installed on the speech compressor allowed direct connection with the remote control unit and permitted the remote control unit to take over the rate-altering control functions of the speech compressor.

The chart recorder used in the study was a Mingraph produced by Esterline Angus. The unit was calibrated to accept dc milliamperes. A regulated power supply, controlled by an extra wafer on the rate control knob of the remote control unit, supplied power to the chart recorder of different voltages based on the setting of the rate control knob. The chart paper, moving at a constant speed of 30 inches per hour, was used to document all settings of the rate control knob per unit of time. Directly following each subject, the chart paper that was expended for the subject was marked to identify the particular subject whose responses were displayed.

Data Analysis

Each subject in the study was provided the listening experience individually in a single session, and served as his own control. Data were examined and analyzed in a number

of different manners to yield information regarding manifest preference for rate and rate manipulation behaviors that occur in a self-paced listening situation.

Criteria were established for this study to define manifest preference for rate and mean manifest rate preference. Two different bases were used to establish the criteria. First, they were based on the limited amount of available information on rate preference and manipulation behaviors. Secondly, the criteria established a structure that would allow non-manipulation of rate for no more than one of the segments for acceptance as demonstrated manifest preference for rate. Data were also analyzed by altering the criteria to further examine acceptable criteria for analysis of self-paced listening behaviors.

The following criteria were established to define manifest preference for rate.

Criterion #1 The final rate for all four segments of a subject's listening experience will fall within a band of 40 wpm.

This criterion was established to guarantee rate alteration of at least three of the four listening segments. Since the rate differences between the four segments (50 wpm, 50 wpm, 75 wpm) were all greater than 40 wpm, a subject would have to alter at least three to yield a final band width of 40 wpm or less. This criterion also accounted for the possibility that the rate of one of the segments might

coincide with the subject's manifest preference for rate. In such an instance, the criterion would accept a single non-manipulated segment, but would demand that the other three segments be manipulated. However, the criterion would not accept a subject as showing a manifest preference for rate who did not manipulate two or more of the segments.

The use of a 40 wpm band was further supported by the Friedman et al study that reported mean rates for three self-paced listening passages of 250 wpm, 254 wpm, and 259 wpm with corresponding standard deviations of 24.5, 31.5, and 42. Based on these findings, 68% of their population (college students) showed preference fluctuations of 49 wpm, 63 wpm, and 84 wpm. The greatest difference between these preference fluctuations (84 wpm - 49 wpm) was 35 wpm. It could be expected that 68% of their population showed manifest preference for rate within a band width of 35 wpm. When 95% of the population is considered, the band width increases to 70 wpm.

Figure 3.2 shows examples of terminal rates that are acceptable and non-acceptable as demonstrating preference.

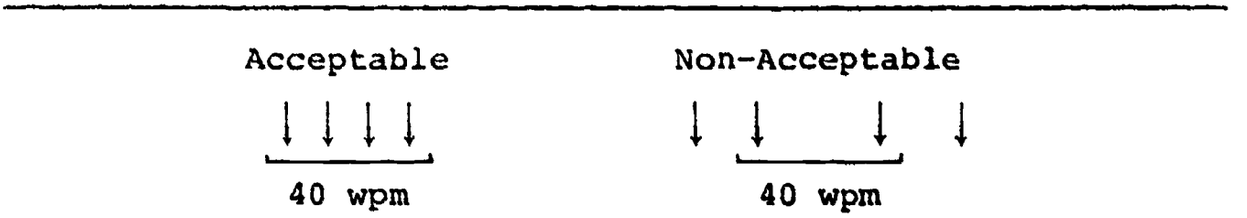


FIGURE 3.2

ACCEPTABLE AND NON-ACCEPTABLE
DEMONSTRATION OF PREFERENCE

Criterion #2 When the terminal rate for one segment is more than 40 wpm away from the band of rates delimited by the other three segments, the rates of these three segments not to exceed a band width of 40 wpm, the fourth rate will be excluded and the remaining three rates will be considered the manifest preference for rate.

This criterion was established to provide for the occurrence of a single terminal rate that deviated greatly from the band of the other three terminal rates. Such an occurrence was considered atypical of manifest preference for rate and the deviant terminal rate was discarded as being incongruent. Figure 3.3 shows a hypothetical example of a terminal rate that is excluded according to Criterion #2 and two terminal rates that can not be excluded according to Criterion #2.

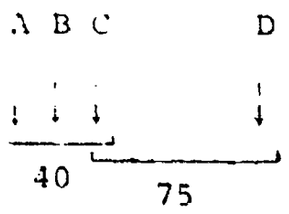
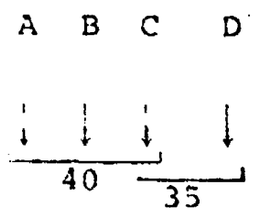
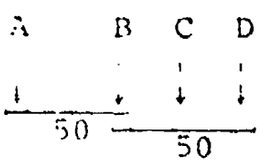
	Three rates accepted as demonstrating manifest preference for rate ("D" is more than 40 wpm away from the band of the other three rates, and the band of the other three rates is less than 40 wpm)
	No demonstration of rate preference ("D" is less than 40 wpm away from the band of the other three rates, though the band of the other three rates is less than 40 wpm)
	No demonstration of rate preference ("A" is more than 40 wpm away from the band of the other three rates, but the band of the other three rates exceeds 40 wpm)

FIGURE 3.3

ANALYZING DEMONSTRATED RATE PREFERENCE ON THE BASIS OF CRITERION #2 WHEN CRITERION #1 HAS NOT BEEN MET

The following criteria were established to define mean manifest preference rate.

Criterion #3 A mean will be calculated for only those subjects who demonstrate a manifest preference for rate.

Criterion #4 Where the standard deviation of the four terminal rates is greater than 15 and the elimination of the terminal rate for a single segment reduces the standard deviation to below 9, this single rate will not be used to calculate the mean and the mean will be calculated by

using the other three terminal rates.

This criterion was established to provide for the situation where three of the terminal rates are extremely similar and a single rate is divergent. In such an instance, it was felt that the mean manifest preference rate was more typical of the mean of the three similar rates than of all four rates.

The defining of the actual limits for Criterion #4 was established through the development of a series of hypothetical situations where terminal rates were examined in relation to their standard deviation. In particular, this criterion allowed for the alteration of extremely skewed distributions, but did not allow for alteration of bimodel distributions, or distributions of limited skewness. Figure 3.4 illustrates the use of Criterion #4 to discard a single skewed terminal rate from use in figuring the mean manifest preference rate.

Figure 3.5 illustrates two instances (limited skewness and bimodal distribution) where the criterion does not allow elimination of a single rate.

Segment	Terminal Rate
A	100 wpm
B	100 wpm
C	110 wpm
D	140 wpm
	$\bar{X}$ = 112.5 wpm
	s = 16.39

Segment	Terminal Rate	
A	100 wpm	Rates Used For Calculating Mean Manifest Preference Rate
B	100 wpm	
C	110 wpm	
	$\bar{X}$ = 103.3 wpm	
	s = 4.7 (s < 9)	

FIGURE 3.4

ELIMINATION OF A SINGLE SKEWED TERMINAL RATE IN CALCULATING THE MEAN MANIFEST PREFERENCE RATE

LIMITED SKEWNESS

Segment	Terminal Rate	
A	100 wpm	Rates Used For
B	100 wpm	Calculating Mean
C	120 wpm	Manifest Preference
D	140 wpm	Rate

$\bar{X}$ = 115 wpm
s = 16.58

Segment	Terminal Rate
A	100 wpm
B	100 wpm
C	120 wpm

$\bar{X}$ = 106.7 wpm
s = 9.43 (s > 9)

BIMODAL DISTRIBUTION

Segment	Terminal Rate	
A	100 wpm	Rates Used For
B	100 wpm	Calculating Mean
C	135 wpm	Manifest Preference
D	140 wpm	Rate

$\bar{X}$ = 118.75 wpm
s = 18.83

Segment	Terminal Rate
A	100 wpm
B	100 wpm
C	135 wpm

$\bar{X}$ = 111.7 wpm
s = 16.5 (s > 9)

FIGURE 3.5

INSTANCES WHEN MEAN MANIFEST PREFERENCE RATE MUST BE CALCULATED FROM ALL TERMINAL RATES

Criterion #5 A mean will be calculated by using no less than three terminal rates.

This final criterion was established to guarantee at least a 75% sample of a subject's self-paced listening behavior for analysis.

Data analysis was also conducted using all four rates without consideration for any of the above criteria. In these instances, "point of convergence" is used to identify the arithmetic mean of all four final selected rates.

Primary data analysis was carried out through a comparison of means and standard deviations for different sets of data. Pearson product moment correlations were computed on the data to yield information regarding the existence of relationships for the different rate manipulation behaviors that were investigated. A significance level of .05 was used to test the significance of relationships and the difference between means.

Additional analyses were carried out to substantiate the use of the defined experimental procedures for the examination of listener rate preference behaviors.

Findings

The data collected in the study are presented in this section and analyzed according to the procedures described earlier in this report. The data and analyses are organized in eight different sections with each section dealing with a separate aspect of the study. Each of the hypotheses presented for study is examined along with other findings that were uncovered in the course of analyzing the data though not formally suggested for examination. These additional examinations were conducted in an attempt to thoroughly and systematically examine all viable procedures for the study of self-paced listening behaviors. Complete data for all subjects are displayed in Appendix B.

Manifest Preference for Rate of Presentation

The primary focus of this study was on the examination of rate preference and whether a subject, when given the opportunity to self-pace the listening task, would demonstrate such a preference. The first hypothesis states that a manifest preference for rate of presentation of recorded

information will be demonstrated when the listener is given autonomous control over the rate of presentation in a self-paced listening situation.

This hypothesis was examined through a series of analyses that were designed to test the hypothesis and also provide detailed information regarding the behaviors of the subjects regarding convergence toward a single point (point of convergence). Convergence, a band width of final selected rates that was narrower than the band width of initial presentation rates, was shown by all subjects in the study.

The convergence behavior and non-convergence behavior demonstrated by the subjects is shown in Table 4.1. The point of convergence is the arithmetic mean of the subject's final selected rates.

TABLE 4.1

CONVERGENCE BEHAVIOR BY NUMBER OF SEGMENTS

	Movement Toward Convergence	Movement Away From Convergence	No Change
Number of Segments	158 (82.3%)	22 (11.5%)	12 (6.25%)

Total number of segments = 192 (48 subjects x 4 segments)

As indicated in Table 4.1, 158 (82.3%) of the 192 listening segments experienced by subjects showed movement

toward a point of convergence. Only 22 (11.5%) of the segments showed subject demonstration of movement away from a point of convergence. On twelve occasions (6.25%), subjects showed no change from initial presentation rate to final selected rate. These non-manipulated segments will be discussed further at a later point in this chapter.

Table 4.2 presents convergence data by subject according to the number of subjects who showed convergence on all four segments (100% of segments show convergence) and the number of subjects who showed convergence on only three segments (75% of segments show convergence).

TABLE 4.2

MOVEMENT TOWARD CONVERGENCE BY NUMBER OF SUBJECTS

	Convergence Shown By Four Segments	Convergence Shown By Only Three Segments	Convergence Shown By Three or Four Segments
Number of Subjects	19	26	45

As indicated by Table 4.2, 45 subjects in the study (94%) showed convergence on either three or four of the four listening segments that each subject experienced. Of this total, 26 subjects showed convergence on all four of the listening segments.

The extent of movement toward the point of

convergence for each subject by listening segment was also examined. For those subjects that demonstrated convergence on at least three of the four listening segments, the extent of movement was calculated and ordered in relation to the extent of the difference between the initial presentation rate and the rate at the point of convergence. The data were examined in relation to the extent of movement of the segment that differed the most from the convergence point and the average extent of movement of the other three segments. Further examination was made between the extent of movement of the segment that differed the most from the point of convergence and the extent of movement of the segment that differed the second most from the point of convergence. Both of these analyses were made to establish the strength of the extent of movement of the segment that differed the most from the point of convergence. The second of these analyses was computed to establish the potential presence of a linear relationship between the extent of movement and the difference between the initial presentation rate and point of convergence. Table 4.3 displays these data.

As is indicated by Table 4.3, nine of the 26 subjects who had only three movements toward the point of convergence had one non-manipulated segment and three segments that showed movement toward the point of convergence. The remaining 17 subjects of those who had only three convergent

TABLE 4.3

EXTENT OF MOVEMENT TOWARD POINT OF CONVERGENCE FOR ALL LISTENING SEGMENTS

Subject #	Mv_1	Mv_2	Mv_3	Mv_4	$\frac{Mv_1+Mv_2+Mv_3}{3}$
Subjects with three movements toward point of convergence and one non-manipulated segment					
8	0	36	80	101	38.67 *+
10	0	64	97	92	53.67 *
15	0	2	27	98	9.67 *+
22	0	60	67	109	42.33 *+
38	0	89	82	86	57.00 *+
39	0	54	120	122	33.00 *+
45	0	61	81	115	47.33 *+
50	5	0	84	100	29.67 *+
51	4	36	0	91	13.33 *+
Subjects with three movements toward point of convergence and one movement away from point of convergence					
2	-1	74	67	99	46.67 *+
4	-21	39	30	80	16.00 *+
9	-11	29	83	90	33.67 *+
11	-21	28	63	105	23.33 *+
17	-12	39	60	81	29.00 *+
18	50	-3	4	164	17.00 *+
20	-45	68	116	140	46.33 *+
24	-44	70	128	155	51.33 *+
27	-26	68	66	72	36.00 *+
31	-13	62	46	71	31.67 *+
32	-12	53	71	104	37.33 *+
33	-11	58	102	76	49.67 *
35	-31	43	57	79	23.00 *+
42	-8	90	125	154	69.00 *+
44	-12	30	81	144	41.00 *+
49	-102	53	69	75	6.67 *+
52	-20	42	65	72	29.00 *+

TABLE 4.3 (cont'd.)

Subject #	Mv_1	Mv_2	Mv_3	Mv_4	$\frac{Mv_1+Mv_2+Mv_3}{3}$
Subjects with all four movements toward point of convergence					
1	12	13	79	130	34.67 *+
3	30	47	62	95.5	46.33 *+
5	15	24	69	99	36.00 *+
7	2	70	81	108	51.00 *+
12	24	62	94	88	60.00 *
14	38	45	102	114	61.67 *+
16	30	27	82	181	46.33 *+
19	42	34	87	104	54.33 *+
21	3	37	86	101	42.00 *+
23	6	63	94	93	54.33 *
25	29	18	99	91	48.67 *
28	20	42	81	103	47.67 *+
29	18	65	74	117	52.33 *+
30	18	43	62	124	41.00 *+
34	22	52	98	105	57.33 *+
37	23	26	70	99	39.67 *+
43	28	46	71	90	48.33 *+
47	21	36	59	166	38.67 *+
53	16	39	70	91	41.67 *+
Subjects with two movements toward point of convergence					
6	110	116	129	112	
46	67	0	0	149	
48	97	0	62	99	

Mv_1 = Extent of movement for segment with least difference between initial rate and rate at point of convergence.

Mv_2 = Extent of movement for segment with second least difference between initial rate and rate at point of convergence.

Mv_3 = Extent of movement for segment with third least difference between initial rate and rate at point of convergence.

Mv_4 = Extent of movement for segment with greatest difference between initial rate and rate at point of convergence.

* = $Mv_4 > \frac{Mv_1+Mv_2+Mv_3}{3}$ + = $Mv_4 > Mv_3$

movements had a single segment where movement toward convergence was not evident. Of these 17 subjects, in all but one instance the non-convergent movement was the smallest of the four movements. Further, in all but one case the non-convergent movement occurred in the listening segment that had an initial presentation rate that was the closest of the four segments to the point of convergence. This finding suggests that the non-convergent movements are relatively small, as compared with a subject's convergent movements, and non-convergent movements occur for those segments that have an initial presentation rate that is very close to the point of convergence.

When the extent of movement for the three segments that have the smallest difference between initial presentation rate and the point of convergence are averaged and compared to the extent of movement of the segment that has the greatest difference between initial presentation rate and the point of convergence, all of the 45 subjects examined, those that showed convergence on three or four segments, showed greater extent of movement for the segment that varies the most between initial presentation rate and point of convergence. This finding suggests that the greatest manipulation of rate by a subject in a self-paced listening situation will occur for those listening experiences that differ the most from a subject's point of convergence. In the study, 93.75% of the subjects demonstrated this behavior.

When the extent of movement of the segment that has the greatest difference between initial presentation rate and point of convergence is compared to the segment with the next largest difference between initial presentation rate and the point of convergence, the data show that the segment with the greatest difference between initial presentation rate and the point of convergence has the greater extent of movement in 40 of 45 cases. When these 40 cases are compared to the total group of 48 subjects, it is seen that 83.3% of the subjects demonstrate this behavior. This finding suggests that a linear relationship may exist for a substantial group of the subjects when the difference between initial rate of presentation and the point of convergence is compared to the extent of movement. An examination of this relationship is shown in Table 4.4.

As is indicated by Table 4.4, 28 of the 48 subjects (58.3%) show a correlation that is greater than chance when the difference between the initial presentation rate and the point of convergence for each of the subject's four listening segments is correlated with the subject's extent of movement. This finding suggests that 58 persons in 100 would be more inclined to demonstrate manifest preference for rate if the initial presentation rate for a listening experience is relatively far from the listener's preferred rate of presentation of recorded information.

The first hypothesis regarding manifest preference

TABLE 4.4

CORRELATIONS BETWEEN THE EXTENT OF MOVEMENT TOWARD POINT OF CONVERGENCE AND THE DISTANCE BETWEEN INITIAL PRESENTATION RATE AND POINT OF CONVERGENCE

Subject #	Correlation Coefficient	Subject #	Correlation Coefficient
20	.9111	14	.9447
19	.9411	12	.9738*
53	.9836*	10	.9599*
48	.3819	9	.9978*
11	.9501*	8	.9608*
31	.9094	7	.9845*
39	.8751	5	.9955*
44	.9950*	3	.9813*
45	.9981*	2	.8922
43	.9560*	1	.9936*
42	.9801*	4	.9096
37	.9999*	6	.1622
34	.9967*	15	.8136
33	.9131	24	.9459
32	.9952*	27	.8495
30	.9935*	35	.9179
29	.9955*	38	.9022
28	.9826*	46	.8046
25	.9462	47	.9630*
23	.9717*	49	.7020
22	.9981*	50	.9899*
21	.9968*	51	.8009
17	.9981*	52	.9762*
16	.9974*	18	.7684

*significant at the .05 level (R > .95, P < .05)

for rate of presentation was further examined through the use of Criterion #1. This criterion defined manifest preference for rate for this study as the total band width for the final selected rates of a subject's four listening segments to be no more than 40 wpm in width. Through this criterion, only those subjects with less than a 40 wpm spread between the highest final selected rate and lowest final selected rate were accepted for further analysis as having a defined manifest preference for rate. Further, Criterion #2 allowed for the elimination of a single final selected rate of one of the listening segments when that final rate exceeded a 40 wpm distance from the grouping of the other three final selected rates; this grouping of the remaining three rates not to exceed a spread of 40 wpm between the highest and the lowest rates.

Table 4.5 presents the findings of the study when Criteria #1 and #2 are applied to the data.

The data show that the percentage of listeners demonstrating a manifest preference for rate (68.75%) is greater than the percentage of listeners not demonstrating a manifest preference for rate (31.25%). The data further supports the hypothesis that a listener, when given autonomous control over the rate of presentation of recorded information in a self-paced listening situation will demonstrate a manifest preference for rate of presentation.

TABLE 4.5

DEMONSTRATED MANIFEST PREFERENCE FOR RATE

	# of Subjects		% of Subjects	
	Rate Preference Demonstrated	No Rate Preference Demonstrated	Rate Preference Demonstrated	No Rate Preference Demonstrated
All Grades	33	15	68.75	31.25
Third Grade	12	4	75.0	25.0
Fourth Grade	10	6	62.5	37.5
Fifth Grade	11	5	68.75	31.25

Table 4.6 shows the quantification of subjects according to the acceptance criteria that were used. Of the 33 subjects that demonstrated manifest preference for rate, 27 subjects (82%) were accepted solely on the basis of Criterion #1. An additional six subjects (18%) were added to this group on the basis of Criterion #2. In terms of the total group of 48 subjects that comprised the study, 56.25% were accepted as showing manifest preference for rate on the basis of Criterion #1 and an additional 12.5% were added on the basis of Criterion #2.

TABLE 4.6

ACCEPTANCE OF MANIFEST PREFERENCE FOR RATE ACCORDING TO CRITERIA #1 AND #2

Total Subjects	Subjects Demonstrating Rate Preference According to Criterion #1	Additional Subjects Demonstrating Rate Preference According to Criterion #2
48	27	6

Mean Manifest Preference Rate

The question of manifest preference for rate was further examined in terms of the mean manifest preference rate of the subjects. Only those subjects who demonstrated a manifest preference for rate according to Criteria #1 and Criteria #2 were used in calculating mean manifest preference rates. Of the 33 subjects who demonstrated a manifest preference for rate, a mean manifest preference rate was calculated on the final selected rate of all four segments for 25 subjects. Six subjects had mean manifest preference rates calculated using three final selected rates based on the exclusion of a single rate that was eliminated by the use of Criterion #2. An additional two subjects had mean manifest preference rates calculated using three final selected rates based on the exclusion of a single rate due to Criterion #4. Criterion #4 provided for cases where a single final selected rate was found to inordinately influence the standard deviation of the mean. The mean manifest preference rate by subject with indications of the implementation of Criteria #2 and #4 are shown in Table 4.7.

TABLE 4.7

MEAN MANIFEST PREFERENCE RATE BY SUBJECT

Subject #	Grade	Mean Manifest Preference Rate X	# Of Segments Used To Calculate Mean
42	3	275.5	4
18	4	264	3 (a)
20	4	261	3 (b)
19	4	240	3 (b)
16	4	235.25	4
44	3	235	3 (a)
14	4	233.5	4
30	5	221.5	4
31	5	218	3 (a)
29	5	217.25	4
43	3	217	4
3	4	216.125	4
39	3	214.3	3 (a)
22	3	206.75	4
7	4	206	4
32	5	205.75	4
45	3	205	4
48	5	203.7	3 (a)
17	4	199.25	4
10	3	196	4
23	3	195.25	4
21	4	193.5	4
9	3	193	4
33	5	193	4
28	5	192.25	4
12	3	189.25	4
34	5	187	4

TABLE 4.7 (cont'd.)

Subject #	Grade	Mean Manifest Preference Rate X	# Of Segments Used To Calculate Mean
25	3	180.5	4
5	4	176	4
37	5	173.24	4
11	5	170.3	3 (a)
53	5	170.25	4
8	3	167	4

(a) = Final selected rate deleted on the basis of Criterion #2

(b) = Final selected rate deleted on the basis of Criterion #4

$\bar{X}$ = 207.62, S.D. = 26.87

As indicated by Table 4.7, the data support the concept that preferred listening rate is an individual skill with considerable variance between subjects. For third, fourth and fifth grade students as a group, the individual mean manifest preference rate of students varies from a low of 167 wpm to a high of 275.5 wpm.

The mean rate preference for each subject was grouped according to grade level and also examined as a total group. The total group mean and the means by grade level along with corresponding standard deviations are presented in Table 4.8.

TABLE 4.8

MEAN MANIFEST PREFERENCE RATE FOR ALL GRADES COMBINED AND BY INDIVIDUAL GRADE

	All Grades	Third Grade	Fourth Grade	Fifth Grade
N	33	12	10	11
$\bar{X}$ (wpm)	207.62	206.2125	222.463*	195.658*
S.D.	26.87	26.92	27.66	18.30

*Significantly different at the .05 level ($p < .05$)

As Table 4.8 indicates, the mean manifest preference rate of the total group was 207.62 wpm. The mean manifest preference rate for the fourth grade subjects is significantly higher than the mean manifest preference rate for the fifth grade group. The standard deviation of the total group was 26.87 and the groupings by grade level showed standard deviations of 26.92 for the third grade, 27.66 for the fourth grade, and 18.30 for the fifth grade. The high standard deviations that were computed provide further support that preferred listening rate is a highly variable attribute and that there is considerable variance among third, fourth, and fifth grade students regarding mean manifest preference rate.

Position of the Longest Non-Manipulated Duration

An analysis was made of periods within each subject's listening experience where the rate was maintained

without manipulation for a period of time. This analysis was made to examine whether the listening segments were of ample duration to allow the demonstration of manifest preferance for rate. For each listening segment, the longest period of non-manipulation was identified in terms of the position of its occurrence. These non-manipulated durations were coded as occurring at either the beginning of the segment, the middle of the segment, or the end of the segment. These data were grouped according to presentation order of the segments. The positions of non-manipulated durations for the first segments were grouped together, positions for the second segments were grouped together, positions for the third segments were grouped together, and positions for the fourth segments were grouped together. A total of eight segments were coded as having the longest non-manipulation duration at the end of the listening segment. Table 4.9 displays these groupings according to presentation order of the segments.

As Table 4.9 indicates, over 60% of the subjects had the longest non-manipulated duration at the end of the listening segment. This is true for all four listening segments. Table 4.9 also indicates that the smallest percentage of subjects had the longest non-manipulated duration at the beginning of the segment and a moderate percentage of the subjects had the longest non-manipulated duration during the middle of the segment. This finding, though supporting

TABLE 4.9

POSITION OF LONGEST NON-MANIPULATED DURATION
IN RELATION TO PRESENTATION ORDER OF SEGMENTS

Presentation Order	# of Subjects According to Position of Longest Non-Manipulated Duration			% of Subjects According to Position of Longest Non-Manipulated Duration		
	Beginning	Middle	End	Beginning	Middle	End
First Segment	2	14	32	4.17	29.17	66.67
Second Segment	1	15	32	2.08	31.25	66.67
Third Segment	6	11	31	12.5	22.9	64.58
Fourth Segment	3	16	29	6.25	33.3	60.4
	$\bar{X} = 3$	$\bar{X} = 14$	$\bar{X} = 31$	6.25	29.17	64.58

the idea that most of the subjects were able to come to rest at the end of the segment, therefore suggesting an ample listening opportunity, is not considered substantial in terms of a true indication of appropriate segment length. If the segment were of appropriate length, it could be expected that a high percentage of subjects would have had the longest non-manipulated duration at the end of the listening segment. The data show that 64.58% of the subjects had the longest non-manipulated duration at the end of the segment. It could also be expected that the percentage of subjects with the longest non-manipulated duration at the end of the segment would increase from segment to segment with the highest percentage of subjects showing the non-manipulated duration at the end of the segment for the fourth listening segment. The findings suggest that an opposite movement occurred in the study.

Non-Manipulated Segments

Of the 33 subjects who demonstrated a manifest preference for rate, six different subjects did not manipulate the rate of presentation at any time during one of the listening segments. This information is shown in Table 4.10.

Of the six non-manipulated segments, five (83.3%) were at the moderately compressed rate (200 wpm), and one was at the normal rate (150 wpm). The largest difference between a subject's mean manifest preference rate and the rate of presentation (difference from preference) of the

TABLE 4.10

DIFFERENCE FROM PREFERENCE
FOR NON-MANIPULATED SEGMENTS

Subject #	Non-Manipulated Segment	Difference from Preference
8	N (150 wpm)	17 wpm
48	M (200 wpm)	3.7 wpm
10	M (200 wpm)	4 wpm
45	M (200 wpm)	5 wpm
22	M (200 wpm)	6.75 wpm
39	M (200 wpm)	14.3 wpm

$\bar{X}$ (difference from preference) = 8.46 wpm

S.D. = 5.24

non-manipulated segments was only 17 wpm. The average difference from preference for all six subjects was 8.46 wpm. This finding indicates that those segments that were non-manipulated were extremely close to the listener's manifest preference for rate.

Altering the Rate Preference Acceptance Band

The concept of manifest preference for rate was further examined in this study by altering the acceptance band width that was used for indicating manifest preference for rate. This ex post facto analysis was conducted to assess the viability of using 40 wpm as a defined band width of final selected rates as an indicator of manifest

preference for rate. Two other acceptance band widths, a stringent band width of 20 wpm and a lenient band width of 60 wpm were imposed on the data. Table 4.11 displays the band width of final selected rates for all subjects in the study with brackets indicating those subjects who demonstrated manifest preference for rate at the 40 wpm band width, the 20 wpm band width (stringent), and the 60 wpm band width (lenient).

As indicated by Table 4.11, when the acceptance level is reduced to a stringent band width of 20 wpm, a total of 14 subjects demonstrate manifest preference for rate. When the acceptance level is increased to a lenient band width of 60 wpm, the number of subjects with demonstrated manifest preference for rate increases to 43.

Table 4.11 also graphically displays the divergence of band widths of final selected rates for individual subjects. There is greater variance across cases than there is within cases. Rather than any central tendency, Table 4.11 shows a skewness indicating manifest preference for rate that moves above the band of word rates used for the original recording. The data are further broken down and presented in Table 4.12 according to the total group and by grade levels.

Table 4.12 indicates that 29.17% of the total group of subjects demonstrate manifest preference for rate when the acceptance band is reduced to a stringent band width of

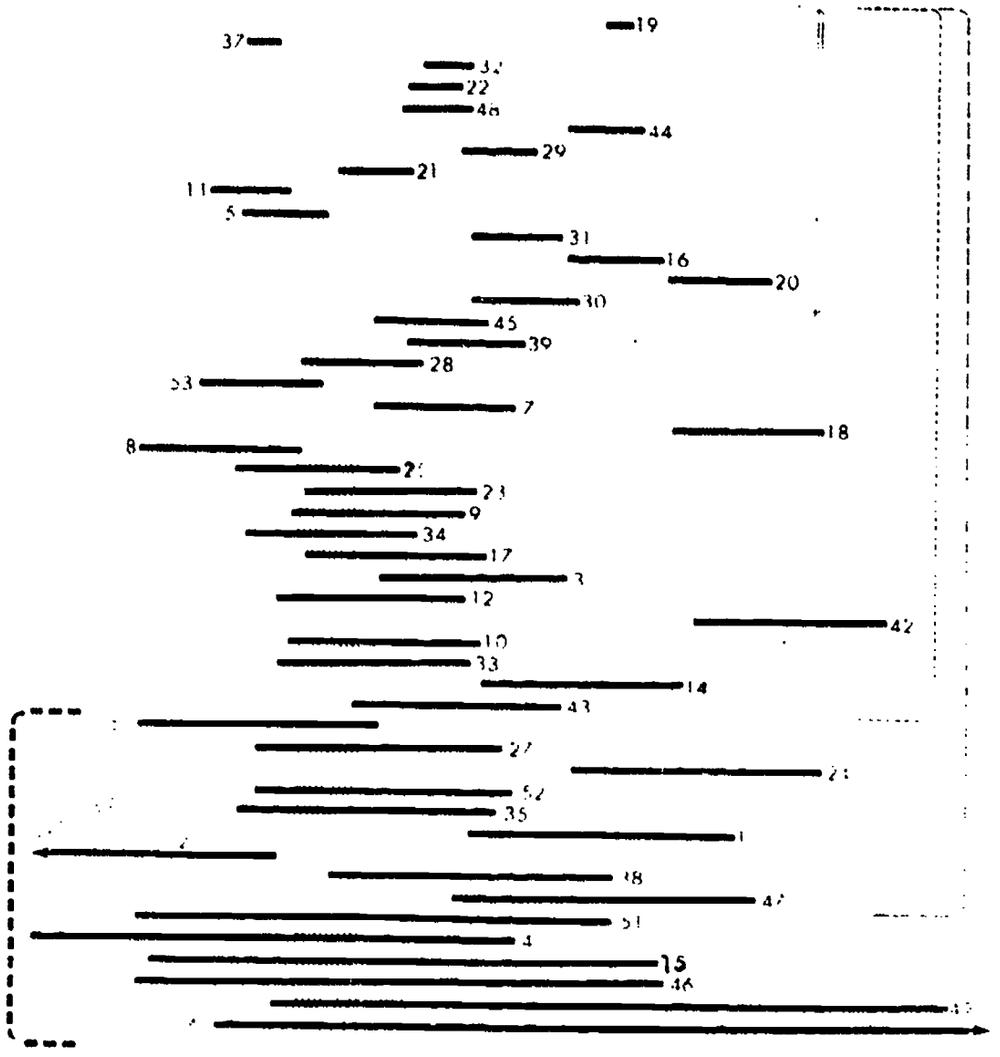


TABLE 4.12

DEMONSTRATED MANIFEST PREFERENCE FOR RATE
AT DIFFERENT ACCEPTANCE LEVELS

Acceptance Band Width	# of Subjects Showing Preference				% of Subjects Showing Preference			
	All Grades	Third Grade	Fourth Grade	Fifth Grade	All Grades	Third Grade	Fourth Grade	Fifth Grade
20 wpm (Stringent)	14	2	5	7	29.17	12.5	31.25	43.75
40 wpm	33	12	10	11	68.75	75.0	62.5	68.75
60 wpm (Lenient)	43	14	13	15	89.58	87.5	81.25	93.75

20 wpm. With a lenient band width of 60 wpm the percentage of subjects demonstrating manifest preference for rate increases to 89.58%. The data further indicate that the fifth grade group is affected the least by the alteration of acceptance band width with a higher percentage of fifth grade subjects remaining in the acceptance group at both the 20 wpm band width and the 60 wpm band width. This finding suggests that the fifth grade group demonstrated less variance among subjects for mean manifest preference rate, as indicated earlier in Table 4.8 where the fifth grade group showed the lowest variance among groups, and that generally the fifth grade subjects demonstrated manifest preference for rate for the total listening experience, all four segments, that were more closely configured. Though the fourth grade subjects showed a higher mean manifest preference rate, the fifth grade subjects showed a more defined mean manifest preference rate.

Rate Manipulation Behavior

The second, third and fourth hypotheses for this study were established to examine possible relationships between a subject's rate manipulation behavior and the difference from preference. The three rate manipulation behaviors examined were a) the time that elapsed before a subject first altered the rate of presentation (previously defined as "manipulation onset"), b) the time that elapsed

prior to when a subject last altered the rate of presentation (previously defined as "manipulation termination"), and c) the time that elapsed between the subject's first alteration of the rate of presentation and the subject's last alteration of the rate of presentation (previously defined as "manipulation duration"). Since the examination of rate manipulation behavior was dependent upon a subject's mean manifest preference rate as one quantity in the establishment of the difference from preference, only those subjects that demonstrated a manifest preference for rate were utilized in the examination of rate manipulation behavior.

All of the rate manipulation relationships were examined through the use of Pearson product moment correlations. It was expected that negative correlations would substantiate that the greater the difference from preference the sooner the manipulation onset would occur. The direction of the correlations for manipulation termination and manipulation duration were not projected in the design of the study. The relationships were tested for significance at the .05 level of probability.

Though a series of listening segments were needed to examine manifest preference for rate, the use of more than a single listening segment for each subject compounded the analysis of rate manipulation behavior. Since each subject in the study yielded four separate sets of scores, one for each listening segment, it was mandatory that the data be

blocked in four separate groupings to compensate for any statistical effect that may be caused by pooling all scores of all subjects and thereby counting a subject's four scores as four different subjects. It could be assumed that a relationship would exist between the rate manipulation behaviors of the four separate segments that a single subject experienced. As such, the blocking procedure effectively turned the analysis of rate manipulation relationships into a series of studies with correlation coefficients derived for each blocking group.

To compensate for any effect the blocking may have had on the analysis of the data, two different blocking procedures were used. First, the scores of the listening segments were blocked according to the initial word rate of the segment. All scores for segments beginning with the same initial word rate, regardless of their presentation order within the total listening experience, were analyzed as a group. Next, the scores of the listening segments were blocked according to the presentation order of the segments. All scores for segments in the same presentation position, regardless of initial word rate, were analyzed as a group. In each of the blocking procedures, a single subject was represented no more than one time in the computation of the correlation coefficient. A total of eight different correlation coefficients were computed for each rate manipulation behavior due to the use of the two different blocking

procedures. Table 4.13 presents the correlation coefficients for the eight blocked groups when the relationship between difference from preference and manipulation onset is examined.

An examination of Table 4.13 indicates that seven of the eight relationships were negative in direction. This is the hypothesized direction. Only two of the relationships were significant at less than the .05 level of significance. Of the two significant relationships, one was positive in direction and the other was negative in direction. When the subjects were blocked by presentation order of the segments the strongest relationship occurred for the first segments with the relationships getting progressively smaller for each successive blocking of segments. Little consistency was shown between correlation coefficients for the different blocked groups which suggests that there is little relationship between manipulation onset and difference from preference as manifest by the subjects. Based on this finding, hypothesis #2 is rejected.

Table 4.14 presents the correlation coefficients for the eight blocked groups when the relationship between difference from preference and manipulation termination is examined.

An examination of Table 4.14 indicates that seven of the eight relationships were negative in direction. None of the relationships tested as significant at less than the

TABLE 4.13

COMPARING MANIPULATION ONSET TO THE DIFFERENCE FROM PREFERENCE

Blocking Group	Number of Cases	Manipulation Onset (seconds)	Correlation Coefficient
100 wpm Segments	31	$\bar{X}$ = 2.145 S.D. = .93	r = -.049
150 wpm Segments	30	$\bar{X}$ = 14.2 S.D. = 28.16	r = -.2959
200 wpm Segments	27	$\bar{X}$ = 7.019 S.D. = 10.38	r = -.2419
275 wpm Segments	30	$\bar{X}$ = 2.45 S.D. = 1.23	r = -.4594*
First Segments	28	$\bar{X}$ = 5.839 S.D. = 10.33	r = -.382*
Second Segments	30	$\bar{X}$ = 6.783 S.D. = 15.69	r = -.237
Third Segments	29	$\bar{X}$ = 5.62 S.D. = 13.88	r = -.217
Fourth Segments	31	$\bar{X}$ = 7.274 S.D. = 21.02	r = -.191

*significant at the .05 level ($p < .05$)

TABLE 4.14

COMPARING MANIPULATION TERMINATION TO THE DIFFERENCE FROM PREFERENCE

Blocking Group	Number of Cases	Manipulation Termination (seconds)	Correlation Coefficient
100 wpm Segments	31	$\bar{X}$ = 101.935 S.D. = 48.058	r = -.2537
150 wpm Segments	30	$\bar{X}$ = 91.8 S.D. = 47.41	r = -.145
200 wpm Segments	27	$\bar{X}$ = 91.46 S.D. = 48.967	r = -.166
275 wpm Segments	30	$\bar{X}$ = 74.23 S.D. = 50.67	r = -.0929
First Segments	28	$\bar{X}$ = 88.46 S.D. = 34.48	r = -.205
Second Segments	30	$\bar{X}$ = 103.27 S.D. = 48.06	r = -.151
Third Segments	29	$\bar{X}$ = 96.069 S.D. = 53.84	r = -.299
Fourth Segments	31	$\bar{X}$ = 72.56 S.D. = 53.93	r = -.182

.05 level of significance. Neither blocking procedure yielded any consistent trend or movement between groupings. Little consistency was shown between correlation coefficients for the different blocked groups suggesting that there is little relationship between manipulation termination and difference from preference. Based on this finding, hypothesis #3 is rejected.

Table 4.15 presents the correlation coefficients for the eight blocked groups when the relationship between difference from preference and manipulation duration is examined.

An examination of Table 4.15 indicates that six of the eight relationships were negative in direction. None of the relationships tested as significant at less than the .05 level of significance. Neither blocking procedure yielded any consistent trend or movement between groupings. Little consistency was shown between correlation coefficients for the relationship between manipulation duration and difference from preference. Based on this finding, hypothesis #4 is rejected.

Analyzing With Reduced Standard Deviations

An examination of the manipulation onsets of the 150 wpm segments, 240 wpm segments, first segments, second segments, third segments, and fourth segments indicated standard deviations that were greater than their respective means. Though statistically acceptable, such a finding

TABLE 4.15

COMPARING MANIPULATION DURATION TO THE DIFFERENCE FROM PREFERENCE

Blocking Group	Number of Cases	Manipulation Duration (seconds)	Correlation Coefficient
100 wpm Segments	31	$\bar{X}$ = 99.79 S.D. = 47.96	r = -.253
150 wpm Segments	30	$\bar{X}$ = 77.60 S.D. = 53.84	r = -.027
200 wpm Segments	27	$\bar{X}$ = 84.47 S.D. = 50.85	r = -.111
275 wpm Segments	30	$\bar{X}$ = 71.78 S.D. = 50.84	r = -.1037
First Segments	28	$\bar{X}$ = 82.625 S.D. = 36.645	r = -.085
Second Segments	30	$\bar{X}$ = 96.48 S.D. = 51.696	r = -.068
Third Segments	2[illegible]	$\bar{X}$ = 90.448 S.D. = 56.46	r = -.3388
Fourth Segments	31	$\bar{X}$ = 65.29 S.D. = 54.47	r = -.1065

suggests that a movement of one standard deviation from the mean would yield a negative manipulation onset time. It is impossible to have a negative manipulation onset time since the subject would have to begin manipulating the rate of presentation before the presentation began. To accommodate for this, the individual manipulation onset times of all subjects were examined to ascertain which times had the greatest effect on the standard deviation. Starting with the manipulation onset time that varied the greatest from the mean, single times were discarded until the standard deviation for each of the blocking groups in question was brought numerically below the mean. By so doing, it was then possible to accommodate at least 68% of the population, one standard deviation above and below the mean, as having manipulation onset times that were not negative. An analysis of relationships was made using this set of data to ascertain whether the previous correlation coefficients (Table 4.13, Table 4.14, and Table 4.15) were inordinately affected by these manipulation onset times with high variance from the mean. A total of eight manipulation onset times were discarded through this procedure. Table 4.16 displays the correlation coefficients for manipulation onset and difference from preference for the altered data set.

An examination of Table 4.16 indicates that six of the eight relationships were correlated in a negative direction. This is a decrease from Table 4.13 where the

TABLE 4.16

COMPARING MANIPULATION ONSET TO THE DIFFERENCE FROM PREFERENCE USING THE ALTERED DATA SET

Blocking Group	Number of Cases	Manipulation Onset (seconds)	Correlation Coefficient
100 wpm Segments	31	$\bar{X}$ = 2.145 S.D. = .93	r = -.049
150 wpm Segments	25+	$\bar{X}$ = 3.96 S.D. = 2.95	r = -.170
200 wpm Segments	24+	$\bar{X}$ = 3.604 S.D. = 2.87	r = -.184
275 wpm Segments	30	$\bar{X}$ = 2.45 S.D. = 1.23	r = .4594*
First Segments	25+	$\bar{X}$ = 2.42 S.D. = 1.618	r = -.345
Second Segments	28+	$\bar{X}$ = 3.45 S.D. = 2.86	r = -.296
Third Segments	28+	$\bar{X}$ = 3.07 S.D. = 2.12	r = .1365
Fourth Segments	29+	$\bar{X}$ = 2.845 S.D. = 2.005	r = -.4386*

*significant at the .05 level ($p < .05$)

+affected by the altered data set

unaltered data showed seven of the eight relationships were significant at less than the .05 level of significance. Of the two significant relationships, one was positive in direction and the other was negative in direction. The positive relationship that was significant was the same as that presented in Table 4.13 since no data from the 275 wpm segments were deleted as having high variance. The negative relationship that was significant occurred for the grouping by fourth segments. Of the six groupings that were altered through the elimination of manipulation onset times that varied greatly from the mean, four yielded lower correlation coefficients than were computed with the unaltered data. Neither blocking procedure yielded any consistent trend or movement between groupings. Little consistency was shown between correlation coefficients for the different blocked groups suggesting that there is little relationship between manipulation onset and difference from preference for the altered data.

Further Analysis for Random Effects

Further analysis of the data was conducted to examine the experimental procedure in an attempt to ascertain whether the listening experience provided appropriate opportunity for all subjects to demonstrate manifest preference for rate. This further analysis was based on the lack of significant relationships between difference from preference and manipulation onset, manipulation termination, and

manipulation duration. Since it was hypothesized that a relationship would exist, it was felt that the nonsignificant finding could not be fully accepted until it could be shown that the data collected truly represented self-paced listening behavior and was not a function of some aspect of the study. The need for further analysis was also suggested when it was found that the longest non-manipulated duration, though occurring at the end of the listening segments for more than half of the subjects, did not occur at the end of the listening segments for all subjects. Further, a decrease in percentage of subjects with the longest non-manipulated duration at the end of the segment occurred from segment to segment with the smallest percentage of subjects showing non-manipulation at the end for the fourth segments.

For this analysis only Criterion #1 was employed. As such, only those subjects with all four final selected rates within a band width of 40 wpm were considered. No subjects were accepted for this further analysis on the basis of Criterion #2 or Criterion #4. Criterion #3 and Criterion #5 were also discarded since their implementation was dependent upon the use of Criterion #2 and Criterion #4. Since Criterion #2 and Criterion #4 provided for exceptions to the other criteria, their elimination in this further analysis provided a sample of subjects that was more stringent than that used in the preceding analyses. The mean

manifest preference rate for this further analysis was calculated on all four final selected rates for each subject.

Correlation coefficients were computed for each of the hypothesized relationships for this group of subjects. Blocking procedures were again employed on the basis of the initial presentation rate of the segment and also on the basis of the order of presentation of the segments.

A series of progressively more stringent acceptance levels were employed for the demonstration of manifest preference for rate. This was accomplished by successively deleting small groups of subjects with the greatest band width of final selected rates. Correlation coefficients were computed for each successively smaller group of subjects. A total of four different groups of subjects were analyzed in this manner. The groups consisted of 27 subjects, 21 subjects, 15 subjects, and 9 subjects. Each smaller group of subjects was a constituent part of all of the larger subject groupings. The data for the comparison of difference from preference and manipulation onset for each of the four groupings is displayed in Table 4.17.

Table 4.17 substantiates that a random effect was present in the collected data. This is shown by the wide variation in correlations for each level of stringency. For the group of 27 subjects, the correlations vary from .414 to -.367. The group of 21 subjects vary from .376 to -.416. The group of 15 subjects vary from .383 to -.456. The group

TABLE 4.17

COMPARING MANIPULATION ONSET TO THE DIFFERENCE FROM PREFERENCE ON THE BASIS OF CRITERION #1 FOR SUCCESSIVELY MORE STRINGENT GROUPINGS

Blocking Group	N = 27 Acceptance Band = 41 wpm		N = 21 Acceptance Band = 36 wpm		N = 15 Acceptance Band = 15 wpm		N = 9 Acceptance Band = 21 wpm	
	Manipulation Onset (seconds)	Correlation Coefficient	Manipulation Onset (seconds)	Correlation Coefficient	Manipulation Onset (seconds)	Correlation Coefficient	Manipulation Onset (seconds)	Correlation Coefficient
100 wpm Segments	$\bar{X}$ = 2.13 S.D. = 1.0	r = -.046	$\bar{X}$ = 2.0 S.D. = .85	r = -.059	$\bar{X}$ = 2.07 S.D. = .961	r = -.108	$\bar{X}$ = 2.17 S.D. = 1.12	r = -.306
150 wpm Segments	$\bar{X}$ = 12.48 S.D. = 27.4	r = -.204	$\bar{X}$ = 14.5 S.D. = 30.98	r = -.161	$\bar{X}$ = 12.18 S.D. = 30.57	r = -.130	$\bar{X}$ = 4.11 S.D. = 3.14	r = -.425
200 wpm Segments	$\bar{X}$ = 7.6 S.D. = 10.9	r = -.218	$\bar{X}$ = 8.45 S.D. = 12.1	r = -.237	$\bar{X}$ = 8.9 S.D. = 13.07	r = -.104	$\bar{X}$ = 4.71 S.D. = 4.46	r = -.402
275 wpm Segments	$\bar{X}$ = 2.31 S.D. = 1.12	r = .414*	$\bar{X}$ = 2.33 S.D. = 1.17	r = .376	$\bar{X}$ = 2.43 S.D. = 1.25	r = .382	$\bar{X}$ = 2.44 S.D. = 1.49	r = .602
First Segments	$\bar{X}$ = 6.3 S.D. = 10.9	r = -.357	$\bar{X}$ = 7.18 S.D. = 12.7	r = -.416	$\bar{X}$ = 7.39 S.D. = 12.85	r = -.4[illegible]	$\bar{X}$ = 2.81 S.D. = 2.56	r = -.491
Second Segments	$\bar{X}$ = 6.88 S.D. = 16.9	r = -.247	$\bar{X}$ = 7.48 S.D. = 18.9	r = -.225	$\bar{X}$ = 3.82 S.D. = 3.13	r = .456	$\bar{X}$ = 4.81 S.D. = 3.85	r = -.395
Third Segments	$\bar{X}$ = 2.85 S.D. = 1.68	r = .054	$\bar{X}$ = 2.5 S.D. = 1.25	r = .092	$\bar{X}$ = 2.61 S.D. = 1.44	r = .088	$\bar{X}$ = 2.72 S.D = 1.80	r = .[illegible]3
Fourth Segments	$\bar{X}$ = 8.02 S.D. = 22.5	r = -.218	$\bar{X}$ = 9.45 S.D. = 25.4	r = -.235	$\bar{X}$ = 10.7 S.D. = 29.8	r = -.247	$\bar{X}$ = 2.89 S.D. = 2.81	r = -.487

*significant at the .05 level ($p < .05$)

of 9 subjects, the most stringent acceptance level, vary from .602 to -.491.

It could be expected that if the scores for manipulation onset truly reflected a predictable behavior of the subjects in a self-paced listening situation that allows for demonstration of manifest preference for rate, an improvement in correlation coef. ents would occur as the groupings became more stringent. In all of the eight blocking groups there is an increase in the correlation coefficient between the least stringent group (N = 27) and the most stringent group (N = 9). However, this improvement, when examined in relation to the four levels of stringency shows erratic movement. When the group of 21 subjects is compared to the group of 27 subjects there is an increase in five of the correlation coefficients. When the group of 15 subjects is compared to the group of 21 subjects there is an increase in four of the correlation coefficients and a decrease in four of the correlation coefficients.

Table 4.17 also indicates a substantial interaction between manipulation onset and presentation order of the segments. The third segment of the listening experience consistently shows a lack of any viable correlation (r = .054, .092, .088, .083). Correlation coefficients for the other segments, though not significant, are all greater than that shown for the third segment.

An interaction between manipulation onset and initial

presentation rate is also shown. The segments that began at the 275 wpm rate consistently show a high positive correlation. Correlations for the segments that begin at other initial presentation rates are all negative.

Table 4.18 presents the correlation coefficients for the eight blocked groups and the different levels of stringency when the relationship between difference from preference and manipulation termination is examined.

Table 4.18 further substantiates the existence of a random effect in the collected data. As was seen in Table 4.13, the data displayed in Table 4.18 shows wide variation in correlation coefficients for each level of stringency. There is no consistent improvement in correlation coefficients as the level of stringency is increased. For three of the blocking groups the correlation coefficients change from negative to positive as the level of stringency increases.

Table 4.19 presents the correlation coefficients for the eight blocked groups and the different levels of stringency when the relationship between difference from preference and manipulation duration is examined.

Table 4.19 further substantiates the existence of random effect in the collected data. As was seen in both previous tables, the data displayed in Table 4.19 shows wide variation in correlations for each level of stringency. There is no consistent improvement in correlation coefficients as the level of stringency is increased. For three of

TABLE 4.18

COMPARING MANIPULATION TERMINATION TO THE DIFFERENCE FROM PREFERENCE ON THE BASIS OF CRITERION #1 FOR SUCCESSIVELY MORE STRINGENT GROUPINGS

Group	N = 27 Acceptance Band = 41 wpm		N = 21 Acceptance Band = 36 wpm		N = 15 Acceptance Band = 15 wpm		N = 9 Acceptance Band = 21 wpm	
	Manipulation Termination (seconds)	Correlation Coefficient	Manipulation Termination (seconds)	Correlation Coefficient	Manipulation Termination (seconds)	Correlation Coefficient	Manipulation Termination (seconds)	Correlation Coefficient
1 wpm Segments	$\bar{X}$ = 107.7 S.D. = 46.6	r = -.071	$\bar{X}$ = 99.64 S.D. = 44.6	r = -.330	$\bar{X}$ = 107.27 S.D. = 42.9	r = -.212	$\bar{X}$ = 117.56 S.D. = 37.2	r = -.247
150 wpm Segments	$\bar{X}$ = 87.0 S.D. = 47.4	r = -.187	$\bar{X}$ = 93.23 S.D. = 44.6	r = -.029	$\bar{X}$ = 92.14 S.D. = 48.1	r = .270	$\bar{X}$ = 84.94 S.D. = 52.5	r = .418
.5 wpm Segments	$\bar{X}$ = 85.54 S.D. = 50.7	r = -.047	$\bar{X}$ = 91.08 S.D. = 53.4	r = -.114	$\bar{X}$ = 102.46 S.D. = 48.3	r = .181	$\bar{X}$ = 116.66 S.D. = 40.7	r = .026
.75 wpm Segments	$\bar{X}$ = 76.37 S.D. = 51.2	r = -.147	$\bar{X}$ = 77.52 S.D. = 49.4	r = -.201	$\bar{X}$ = 81.7 S.D. = 50.3	r = -.138	$\bar{X}$ = 81.5 S.D. = 45.7	r = -.299
First Segments	$\bar{X}$ = 91.26 S.D. = 34.2	r = -.137	$\bar{X}$ = 86.73 S.D. = 35.8	r = -.246	$\bar{X}$ = 98.54 S.D. = 29.9	r = -.078	$\bar{X}$ = 105.13 S.D. = 33.1	r = -.316
Second Segments	$\bar{X}$ = 103.48 S.D. = 46.7	r = -.046	$\bar{X}$ = 109.93 S.D. = 41.1	r = -.095	$\bar{X}$ = 120.71 S.D. = 45.1	r = -.135	$\bar{X}$ = 117.88 S.D. = 37.4	r = -.183
Third Segments	$\bar{X}$ = 88.56 S.D. = 55.1	r = .249	$\bar{X}$ = 95.63 S.D. = 53.8	r = .227	$\bar{X}$ = 92.29 S.D. = 55.1	r = .188	$\bar{X}$ = 93.0 S.D. = 54.1	r = .371
Fourth Segments	$\bar{X}$ = 67.11 S.D. = 57.4	r = -.211	$\bar{X}$ = 70.0 S.D. = 52.3	r = -.246	$\bar{X}$ = 73.0 S.D. = 54.2	r = -.049	$\bar{X}$ = 83.67 S.D. = 53.8	r = .449

TABLE 4.19

COMPARING MANIPULATION DURATION TO THE DIFFERENCE FROM PREFERENCE ON THE BASIS OF CRITERION #1 FOR SUCCESSIVELY MORE STRINGENT GROUPINGS

Blocking Group	N = 27 Acceptance Band = 40 wpm		N = 21 Acceptance Band = 30 wpm		N = Acceptance Band = 25 wpm		N = 9 Acceptance Band = 21 wpm	
	Manipulation Duration (seconds)	Correlation Coefficient	Manipulation Duration (seconds)	Correlation Coefficient	Manipulation Duration (seconds)	Correlation Coefficient	Manipulation Duration (seconds)	Correlation Coefficient
100 wpm Segments	$\bar{X}$ = 103.46 S.D. = 46.5	r = -.271	$\bar{X}$ = 97.64 S.D. = 44.6	r = -.329	$\bar{X}$ = 105.2 S.D. = 42.9	r = -.210	$\bar{X}$ = 115.33 S.D. = 37.2	r = -.239
150 wpm Segments	$\bar{X}$ = 75.[illegible] S.D. = [illegible]	r = -.062	$\bar{X}$ = 78.73 S.D. = 51.2	r = .071	$\bar{X}$ = 79.96 S.D. = 52.9	r = .320	$\bar{X}$ = 80.83 S.D. = 53.4	r = .436
200 wpm Segments	$\bar{X}$ = 80.97 S.D. = 52.4	r = -.194	$\bar{X}$ = 82.67 S.D. = 55.4	r = -.059	$\bar{X}$ = 93.54 S.D. = 50.3	r = .[illegible]	$\bar{X}$ = 11[illegible].14 S.D. = 4[illegible].4	r = [illegible]
275 wpm Segments	$\bar{X}$ = 74.06 S.D. = 51.3	r = -.156	$\bar{X}$ = 75.19 S.D. = 49.5	r = -.210	$\bar{X}$ = 79.2[illegible] S.D. = 50.4	r = .147	$\bar{X}$ = [illegible].08 S.D. = 4[illegible]	r = .31[illegible]
First Segments	$\bar{X}$ = 84.96 S.D. = 36.9	r = -.019	$\bar{X}$ = 79.55 S.D. = 38.4	r = -.099	$\bar{X}$ = 91.14 S.D. = 32.2	r = .064	$\bar{X}$ = 102.31 S.D. = 34.3	r = -.265
Second Segments	$\bar{X}$ = 96.6 S.D. = 51.3	r = .039	$\bar{X}$ = 102.45 S.D. = 46.8	r = .007	$\bar{X}$ = 116.89 S.D. = 36.9	r = -.092	$\bar{X}$ = 113.06 S.D. = 38.2	r = -.139
Third Segments	$\bar{X}$ = 95.71 S.D. = 55.2	r = .237	$\bar{X}$ = 93.13 S.D. = 53.[illegible]	r = 25[illegible]	$\bar{X}$ = 89.68 S.D. = 55	r = 185	$\bar{X}$ = 90.28 S.D. = 54.[illegible]	r = 468
Fourth Segments	$\bar{X}$ = 58.13 S.D. = 52.3	r = 117	$\bar{X}$ = 60.55 S.D. = 52.4	r = -.132	$\bar{X}$ = 62.[illegible] S.D. = 59.6	r = 084	$\bar{X}$ = 89.78 S.D. = 55.3	r = 462

the blocking groups, the correlation coefficients change from negative to positive as stringency is increased; one group changes from positive to negative; and one group shifts from negative to positive and then returns to negative.

Conclusions, Discussion, Implications

The purpose of this study was to investigate listener behaviors that are manifest when a listener is given autonomous control over a self-paced listening situation. More specifically, this study examined whether it is possible to ascertain listeners' manifest preferences for rate of presentation of recorded information, the conditions that must exist for rate preference to be demonstrated, and whether relationships exist regarding the rate-altering behaviors of listeners who are provided the opportunity to control their own listening experience.

This section presents the conclusions that were drawn from the research and discusses each. Implications will be drawn from the conclusions and recommendations made regarding further research in the area of listening rate preference.

Conclusions

The following conclusions have been drawn from the findings of this study:

1. Elementary school children, those in the third, fourth and fifth grade, will manipulate the rate of presentation of recorded information in a self-paced listening situation.

2. Elementary school children, those in the third, fourth and fifth grade, demonstrate a manifest preference for rate.

3. The extent a listener alters the rate of presentation is positively related to the difference between the initial rate of presentation of recorded information and the listener's manifest preference for rate.

4. Precise manipulation behaviors that relate predictably to the difference from preference are not manifest in the self-paced listening situation as defined in this study.

Discussion

The discussion of findings is organized in six different areas of focus with each area discussed separately.

Discussion of rate manipulation. This study shows that when elementary school children in the third, fourth and fifth grade are provided an opportunity to manipulate the rate of presentation of recorded information in a self-paced listening situation they will manipulate the rate. This is the most basic finding of the study. The data indicate that in only 12 of a total of 192 instances that were evaluated

was the rate not manipulated. In those instances where there was no manipulation of rate of presentation, the initial presentation rate was very close to the mean manifest preference rate of the subject.

Discussion of manifest preference for rate. The study substantiated that there exists a manifest preference for rate of presentation. This was substantiated when it was found that all subjects manipulated the presentation rate for the total listening experience to evolve a group of final selected rates that was narrower in band width than the band width of the rates used for the initial presentations of the listening segments.

Manifest preference for rate was further examined in relation to convergence toward a common point. It was found that 82.3% of all of the individual listening segments were manipulated by the listener toward a point of convergence. This finding suggests that when a listener is provided with a listening experience and is also provided the opportunity to manipulate the rate in a self-paced manner, the listener's manipulation will in most cases be focused toward a point of convergence. The study further showed that approximately 58% of the listeners demonstrated this convergence behavior in a manner that was directly related to the amount of the difference from preference. As the difference from preference increased, the subject would move the presentation rate a greater distance toward preference. The smaller

differences from preference showed the least amount of movement. The high instance of linear correlations among subjects further substantiates the existence of a manifest preference for rate and also provides an indication of the type of manipulation behavior that is apparent when a subject is provided a self-paced listening situation with autonomous control over the rate of presentation of recorded information.

The manifest preferences for rate demonstrated in the study were highly divergent with no evident central tendency for the total group or subgroups by grade level. This finding supports the individualization of manifest preference for rate. Based on this finding it appears to be inappropriate to treat listeners in groups with pre-selected word rates used for presentation of recorded information. The most appropriate procedure would be the design of individual listening experiences with the word rate selected according to the individual listener's manifest preference for rate.

Discussion of mean manifest preference rate. Previous research in the area of compressed speech has indicated that listeners, at different age levels, can listen to recorded material at rates as high as 225 wpm to 350 wpm with little or no loss in comprehension from normal rates. The mean manifest preference rates of listeners for rate varied from 167 wpm to 275.5 wpm. The mean manifest preference rate for all subjects who demonstrated a manifest preference

for rate was 207.62 wpm. Though this finding indicates a mean manifest preference rate that is higher than normal conversational rates or the rates that are encountered in commercially prepared recorded material, it still falls below the potential rate that can be accommodated by a listener. Only seven subjects of those that demonstrated a manifest preference for rate (21%) indicated a mean manifest preference rate that exceeds 225 wpm, one of the lowest maximum rates where comprehension is still maintained. If 275 wpm is considered as a maximum rate where comprehension is still maintained, a finding supported in a number of studies, only one subject in the present study would be considered as operating as an efficient listener. The data that were analyzed in this study regarding mean manifest preference rate support the proposition that when a listener is provided his own speech compressor for listening to recorded information he will select a rate lower than the potential rate that he could use without loss of comprehension.

It should be remembered, however, that the mean manifest preference rate is dependent upon the procedure used in this study for defining manifest preference for rate. For this study, the primary purpose for ascertaining the mean manifest preference rate was to provide one of the numerical boundaries in the computation of a subject's difference from preference. As such, it allowed for the analysis of rate manipulation behaviors as related to the difference from

preference.

Discussion of manipulation behaviors in relation to difference from preference. The manipulation of rate by all subjects, though substantiated in the study, was also shown to be a primary cause of concern in the interpretation of the collected data. It was hypothesized that relationships would exist between difference from preference and manipulation onset, manipulation termination, and manipulation duration. These relationships were examined and it was found that the data, when blocked in different manners, provided conflicting results. Such conflicting results can be attributed to one of two possible reasons. First, there is really no relationship for these variables in a self-paced listening situation. Such an explanation is possible, but is not felt to be plausible since it is assumed that manipulation behaviors must be stimulated by some aspect of the listening experience that is provided.

The second reason for not finding relationships is that whatever relationships did exist may have been of a random nature rather than correlational. If so, the collected data may be representative of initial exposure to self-paced listening by the subjects. It was shown that the subjects did manipulate the rate, but this manipulation may not have been guided by the initial rate of presentation, the difference from preference, or the subjects' desire to arrive at a preferred rate. Instead, the manipulation of

rate may have been guided primarily by the subjects' desire to "play" with the presentation rate and explore the phenomenon of rate-altered speech.

The existence of a random effect is seen as the strongest reason for the lack of manipulation onset, manipulation termination, and manipulation duration correlations in this study. It should be noted, as was pointed out earlier, that the absence or lack of these correlations does not imply the absence of demonstrated behavior. In fact, it can be concluded from the study that a self-paced listening experience as defined in the study will lead to the demonstration of random manipulation behaviors (those that relate to onset, termination, and duration) that do not relate predictably to a difference between presentation rate and the subject's preferred rate. This random behavior may be an attribute of the population that was sampled for the study, the specific sample that was used, or listeners in general.

Discussion of listening segment length for demonstration of manifest preference for rate. There is considerable difference of opinion among researchers in the area of compressed speech regarding the appropriate length of a recorded passage to allow for the demonstration of listener manifest behaviors that are representative of the listener's typical listening behavior. In the present study, the use of listening passages that were between 444 words in length and 503 words in length proved sufficient to allow for more

than half of the subjects (68.75%) to demonstrate manifest preference for rate. However, the randomness of the manipulation behaviors may have resulted, in part or wholly, from the brevity of the listening experience. It is not known at this time whether such random behaviors are replaced by predictable behaviors over time and would therefore be observable in either a long listening experience or a series of repeated exposures to listening experiences of this length.

The total elapsed time for participation by any one subject in the experiment did not exceed twenty minutes in duration. This aspect is seldom considered in listening studies. Except for blind listeners who are dependent upon hearing for a large percentage of information reception and consequently have developed attending behaviors that are compatible with this necessity, most sighted listeners can attend to strictly auditory experiences for relatively short periods of time. It should also be pointed out that solely auditory based experiences are atypical for sighted listeners since most sighted listeners utilize some form of visual focus while listening. A visual focus was provided the listeners in this experiment. It is not known whether this visual focus confounded the listening experience in some unsuspected way. No overt behaviors were noted during the experiment to indicate any negative effect of the visual focus material.

Discussion of acceptance band width. The defining of manifest preference for rate as an allowable range of 40 wpm in three final selected rates while allowing the exclusion of one divergent rate is the most difficult criterion to validate. This criterion was proposed based on the Friedman et al findings and also was proposed due to the demand the criterion made on manipulation of rate for demonstration of preference. Further, it accommodated for atypical final selected rates. The 40 wpm band width and exception rule were supported in this study as an acceptance level in the following ways:

1. The percentage of subjects who demonstrated manifest preference for rate at this acceptance level (68.75%) is very similar to the percentage of subjects who had their longest non-manipulated duration at the end of the listening segment (64.58%). Such a finding suggests that subjects that came to rest for the longest period of time at the end of their listening segment were those subjects that had arrived at their rate preference. The similarity in percentages of subjects indicates appropriateness of the acceptance criteria.

2. If we eliminate the sub-criterion allowing exclusion of a single deviant final rate (Criterion #2), the percentage of subjects showing manifest preference for rate drops to 56.25% and therefore numerically moves away from the percentage of subjects with the longest non-manipulated

duration at the end of the segment (64.58%).

3. The listening segments that were not manipulated for their entirety were no more than 17 wpm away from the subject's manifest preference for rate. It can be assumed that the rate of a segment which has not been manipulated is extremely close to a subject's manifest preference for rate. The non-manipulation is therefore considered a function of this proximity. A band width acceptance level smaller than 17 wpm would have precluded this finding. It can be said, based on the data from this study, that the band width for acceptance of manifest preference for rate must be at least 17 wpm in width to account for all instances of non-manipulation as evidences of acceptance within the preferred rate band.

Implications

The conclusions drawn from this study have implications in a number of different areas. The research was undertaken to investigate two of these areas. The following implications are drawn in relation to these defined areas, both of which relate to curricular applications of individual rate preference. These defined areas are 1) the development of efficient listening behaviors on the part of students, and 2) the utilization of appropriate recorded instructional formats to motivate a listener to manipulate the rate of presentation to better accommodate his individual preference.

Implications for the development of efficient listening behaviors. This study has suggested a disparity between the rate at which a student can listen to recorded information and the rate at which he prefers to listen to recorded information. Further substantiation of this disparity in future research will assist in establishing the parameters of the task of training a listener to utilize efficient listening behaviors. Many attempts have been made to train a listener to comprehend at high rates of presentation. These attempts have met with varying degrees of success. With the advent of inexpensive speech compression playback equipment, many listeners will for the first time have the opportunity to self-pace the listening task. Their listening will not be guided by an understanding of how fast they can listen, but instead by how fast they want to listen.

To create an efficient listening environment for the listener demands a training procedure that will successfully increase the rate at which a listener prefers to listen. The degree of efficiency depends on the ability of the training procedure to move the preference to the point of maximum rate input. The starting point for the development of training procedures of this nature is the establishment of the limits of the training problem. To evaluate the success of any training procedure demands that you know where the learner is prior to training so that an assessment of rate preference change can be made. An appropriate training

procedure is one which decreases the difference between manifest preference for rate of presentation and potential rate of presentation. This study has established the presence of manifest preference for rate and has also suggested the presence of a manifest preference for rate that is below the potential rate for a listener.

Implications for the utilization of instructional formats that promote manipulation of rate to accommodate individual preference. This study has shown that the extent of manipulation of rate of presentation of recorded information is dependent upon the difference between the rate of presentation and the rate at which the listener prefers to listen. The implication of this finding is of primary benefit to those individuals who are involved with the design of recorded materials for student use. If a tape recording is designed for playback by a student through the use of a speech compressor, the findings of this study would suggest that the recording be created at a rate that is divergent from the rate preference of the intended listener if manipulation of rate is desired. This finding further suggests that previous attempts to pre-compress recorded material to presentation rates that match the student's level will not be appropriate procedures for the design of materials for use in self-paced listening environments. The use of pre-compressed tapes that attempt to match the listener's rate will serve to stifle rate manipulation if the pre-compressed

rate is close to the listener's preferred rate. This study has also pointed out that listening rate is a matter of individual preference and it may not be practical to attempt to match individual rate preferences with a finite selection of rates on pre-compressed recordings.

Further research is suggested in response to the following questions that have been generated by this study:

1. Do all listeners have a manifest preference for rate?

2. Are there variables, other than difference from preference, that relate predictably to rate manipulation behaviors?

3. Is a listener's mean manifest preference rate dependent upon the nature of the recorded information that is presented? If there is an interaction between mean manifest preference rate and nature of recorded information, is the interaction similar to that between potential rate of reception and nature of recorded information?

4. Is it possible to alter a listener's mean manifest preference rate?

5. Are there definable differences in populations that will yield differences in mean manifest preference rates? Do auditory learners demonstrate higher mean manifest preference rates than visual learners? Do high school students demonstrate higher mean manifest preference rates than elementary grade students?

6. How does manifest preference for rate relate to comprehension? Is comprehension of recorded information improved when the rate of presentation of the information is close to a listener's mean manifest preference rate?

Previous research has substantiated that most people prefer learning by reading to learning by listening. It is felt that this preference is fostered through the inability to successfully individualize the listening task. The ability to self-pace the listening task, the design of instructional materials that capitalize on self-paced listening environments, and training procedures that make self-paced listening more efficient will move learning by listening a step closer to learning by reading. The implications for education and learning are great. Learning by listening may eventually become a viable alternative for many students who are not successful with learning by reading.

BIBLIOGRAPHY

Bixler, R. H., Foulke, E., Amster, C. H., and Nolan, C. Y. Comprehension of Rapid Speech by the Blind: Part 1. Cooperative Research Project #1005, Office of Education, Washington, D.C.: U.S. Department of Health, Education, and Welfare, 1961.

Challis, J. The Effect of Fixed and Learner Selected Rates of Compressed Speech in an Audio-Tutorial Learning Environment on the Achievement of College Level Students. Presentation at the Association for Educational Communication and Technology Convention, Atlantic City, 1974.

Diehl, F., White, R. C., and Burk, K. "Rate and Communication." Speech Monographs, 26:229-32, 1959.

Durrell, D. "Listening Comprehension Versus Reading Comprehension." Journal of Reading, 12:455-460, 1969.

Fairbanks, G., Everitt, W. H., and Jaeger, R. "Method for Time or Frequency Compression-Expansion of Speech." Transactions of the Institute of Radio Engineers, Professional Group in Acoustics, pp. 7-12, 1954.

Fairbanks, G., Guttman, N., and Miron, M. S. "Auditory Comprehension of Repeated High-Speed Messages." Journal of Speech and Hearing Disorders, 22:20-22, 1957a.

Fairbanks, G., Guttman, N., and Miron, M. S. "Effects of Time Compression upon the Comprehension of Connected Speech." Journal of Speech and Hearing Disorders, 22:10-19, 1957b.

Fergen, G. K. Listening Comprehension at Controlled Rates for Children in Grades IV, V, and VI. Unpublished doctoral dissertation, University of Missouri, 1954.

Fisher, A. "Science Newsfront." Popular Science, 204:30, 1974.

Foulke, E. "A Survey of the Acceptability of 'Rapid Speech,'" Technical Report, Cooperative Research Project No. 2430, U.S. Office of Education and University of Louisville, Louisville, Kentucky, October 1965.

Foulke, E., Amster, C. H., Nolan, C. Y., and Bixler, R. H. "The Comprehension of Rapid Speech by the Blind." Exceptional Children, 29:134-141, 1962.

Foulke, E., and Sticht, T. "Listening Rate Preferences of College Students for Literary Material of Moderate Difficulty." Journal of Auditory Research, 6:397-401, 1966.

Friedman, H., Graae, C. and Orr, D. Further Research on Speeded Speech as an Educational Medium--Effects of Listening Aids and Self-Pacing on Comprehension and the Use of Compressed Speech for Review. Report No. R67-2. Silver Spring, Maryland: American Institutes for Research, 1967.

Garvey, W. D. "The Intelligibility of Speeded Speech." Journal of Experimental Psychology, 45:102-108, 1953.

Goldstein, H. Reading and Listening Comprehension at Various Controlled Rates. Teachers College, Contributions to Education, No. 821, New York: Bureau of Publications, Teachers College, Columbia University, 1940.

Gropper, R. "Comprehension of Narrative Passages by Fourth-Grade Children as a Function of Listening Rate and Eleven Predictor Variables." Proceedings of the Second Louisville Conference on Rate and/or Frequency-Controlled Speech: October 22-24, 1969. Louisville: Center for Rate-Controlled Recordings, University of Louisville, pp. 231-252, 1971.

Grumpelt, H. and Rubin E. "Speed Listening Skill by the Blind as a Function of Training." Journal of Educational Research, 65:467-471, 1972.

Harwood, K. A. "Listenability and Rate of Presentation." Speech Monographs, 22:57-59, 1955.

Miller, G. A., and Licklider, J. C. R. "The Intelligibility of Interrupted Speech." Journal of the Acoustical Society of America, 22:167-173, 1950.

Nelson, H. E. "The Effect of Variation of Rate on the Recall by Radio Listeners of 'Straight' Newscasts." Speech Monographs, 15:173-80, 1948.

Orr, D. B., Friedman, H. L., and Williams, J. C. C. "Trainability of Listening Comprehension of Speeded Discourse." Journal of Educational Psychology, 56:148-56, 1965.

Press Release, Cambridge Research and Development Group, Westport, Connecticut. January 21, 1974.

Spicker, H. H. Listening Comprehension and Retention of Intellectually Normal and Retarded Children as a Function of Speaking Rate and Passage Difficulty. Unpublished doctoral dissertation, Peabody College, 1963.

Sticht, T. "Some Relationships of Mental Aptitude, Reading Ability Using Normal and Time-Compressed Speech." Journal of Communication, 18:243-258.

Sticht, T. "Mental Aptitude and Comprehension of Time-Compressed and Compressed-Expanded Listening Selections." Journal of Auditory Research, 10:103-109, 1970.

Wood, C. D. Comprehension of Compressed Speech by Elementary School Children. Unpublished doctoral dissertation, Indiana University, 1965.

APPENDIX A

TAPESCRIPT
LISTENER INSTRUCTIONS

Introductory Instructions

During the next few minutes we are going to be listening to some tape recordings. Before we begin I'd like to tell you about the box in front of you. It's a rather interesting box. It can speed up and slow down tape recordings. It can make them go faster or slower. On the front of the box is a black knob. When you turn this knob you can make the recording go faster or slower. You can turn the knob either way. One way will make the recording go slower. The other way will make the recording go faster. Let's try the knob. Turn the knob so that I am talking slower. Do it now. Make me go even slower. Keep turning the knob so that I am talking slower and slower. Now faster. You can make me go faster or slower. I'm going to count to ten and you turn the knob to slow me down. See how slow you can make me count. One, two, three, four, five, six, seven, eight, nine, ten.

Now faster. Now turn the knob so that I am talking faster. Make me go faster. Can you make me go even faster? I'm going to count to twenty. See how fast you can make me count. One, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty. Slow down now. Turn the knob so that you like the speed at which I am talking. Keep turning the knob until you find the place where you like the speed. Find the place where I am talking at the speed that you would like to listen to me. Do you like this speed? Turn the knob until you find the place where you like the speed. Make me talk at the speed that you like.

My friend, Jerry, is going to be reading a story about a train. This story is divided into different sections. Jerry doesn't always talk at the same speed. Jerry reads some sections fast and some sections slow. If Jerry

is talking too fast, turn the knob so that he talks slower. If Jerry is talking too slow, turn the knob so that he talks faster. You can make Jerry talk at the speed that you like.

My name is Joe. I'm here for two reasons. I want to give you some pictures to look at while you're listening to the story. The other reason I'm here is so that I can talk to you about the train story after you hear the recording. Now let's get ready for Jerry. Jerry likes to start talking when the arrows are pointing at each other. Let's turn the knob, right now, so that the arrows are pointing at each other. (PAUSE - Observer checks arrow setting.) That's good. Now I'm going to change to Jerry's tape.

(First segment of story)

Instructions for Other Segments

Return the knob so that the arrows are pointing at each other. Make sure the arrows are now pointing at each other. Lift the page of the book so that the next picture is showing. This picture goes with the next part of our story.

APPENDIX B

DATA BY SUBJECT

Subject #	Stimulus Tape #	First Segment				Second Segment			
		Final Rate	Onset Time	Termination Time	Duration Time	Final Rate	Onset Time	Termination Time	Duration Time
1	1	212	-	-	-	230	-	-	-
2	7	167	-	-	-	149	-	-	-
3	2	230	4	86.5	82.5	212	1	143.5	142.5
4	8	130	-	-	-	189	-	-	-
5	3	185	2	144.5	142.5	176	6	92	86
6	9	212	-	-	-	165	-	-	-
7	4	202	1	85.5	84.5	220	3	128	125
8	1	164	32	87	55	180	1.5	155	153.5
9	7	190	1	33	32	179	87	93	6
10	2	200	0	0	0	214	20	29.5	9.5
11	3	221	2.5	86	83.5	170	5.5	24	18.5
12	8	188	2.5	89.5	67	212	3	123	120
14	10	214	3	135.5	132.5	230	2.5	115.5	113
15	5	200	-	-	-	198	-	-	-
16	11	231	1.5	126.5	125	230	2	61.5	59.5
17	6	212	29	31	2	215	3.5	59	55.5
18	12	264	2	64	62	250	2	99.5	97.5
19	1	242	3	103.5	100.5	204	1	105	104
20	7	249	2	100.5	98.5	266	2	22	20
21	2	197	2	139	137	187	3	142	139

DATA BY SUBJECT (cont'd.)

Subject #	Stimulus Tape	First Segment				Second Segment			
		Final Rate	Onset Time	Termination Time	Duration Time	Final Rate	Onset Time	Termination Time	Duration Time
22	11	209	2	57.5	55.5	200	0	0	0
23	3	194	42	116	74	181	3	154	151
24	5	270	-	-	-	255	-	-	-
25	9	199	2	81.5	79.5	184	4	74.5	70.5
27	11	172	-	-	-	174	-	-	-
28	6	180	2.5	50.5	48	194	2	88.5	86.5
29	12	217	1	81	80	218	13	110	97
30	1	218	2	122	120	224	1	115	114
31	7	171	2	144.5	142.5	212	3.5	131	127.5
32	2	212	9	68	59	203	3.5	157.5	154
33	5	211	1.5	124.5	123	176	1.5	178	176.5
34	8	198	1.5	110.5	109	202	1	74.5	73.5
35	11	179	-	-	-	169	-	-	-
37	12	170	3	102.5	99.5	174	3	173	170
38	4	200	-	-	-	239	-	-	-
39	10	222	2.5	32.5	30	221	3.5	83.5	80
42	12	254	2	24.5	22.5	290	.5	15.5	15
43	3	228	4.5	83	78.5	229	2.5	42	39.5
44	9	244	1.5	99	97.5	287	2.5	100	97.5
45	4	200	0	0	0	211	7	92	85
46	10	249	-	-	-	208	-	-	-
47	8	266	-	-	-	209	-	-	-
48	4	200	0	0	0	212	11	174.5	163.5
49	10	175	-	-	-	222	-	-	-
50	5	195	-	-	-	184	-	-	-

DATA BY SUBJECT (cont'd.)

Subject #	Stimulus Tape	First Segment				Second Segment			
		Final Rate	Onset Time	Termination Time	Duration Time	Final Rate	Onset Time	Termination Time	Duration Time
51	6	196	-	-	-	239	-	-	-
52	9	172	-	-	-	210	-	-	-
53	10	170	1.5	118	116.5	184	1.5	147	145.5

Subject #	Stimulus Tape	Third Segment				Fourth Segment			
		Final Rate	Onset Time	Termination Time	Duration Time	Final Rate	Onset Time	Termination Time	Duration Time
1	1	229	-	-	-	262	-	-	-
2	7	176	-	-	-	126	-	-	-
3	2	195.5	2	145.5	143.5	227	1	121	120
4	8	221	-	-	-	195	-	-	-
5	3	174	1	42	41	169	1	159	158
6	9	279	-	-	-	316	-	-	-
7	4	194	2	18	16	208	1	53	52
8	1	150	0	0	0	174	2	10	8
9	7	192	3	113	110	211	6	95.5	89.5
10	2	192	5	188.5	183.5	178	4	7	3
11	3	178	77	79	2	163	2.5	54.5	52
12	8	176	3	7	4	181	2	14.5	12.5
14	10	238	8	71	63	252	2.5	101	98.5

DATA BY SUBJECT (cont'd.)

Subject #	Stimulus Tape	Third Segment				Fourth Segment			
		Final Rate	Onset Time	Termination Time	Duration Time	Final Rate	Onset Time	Termination Time	Duration Time
15	5	248	-	-	-	152	-	-	-
16	11	232	1.5	137	135.5	248	2	103	101
17	6	181	2	100.5	98.5	189	25	108	83
18	12	278	1	35	34	154	2	119.5	117.5
19	1	237	3.5	7.5	4	241	1.5	7.5	6
20	7	230	1	109	108	268	5	12.5	7.5
21	2	201	3	159.5	156.5	189	2.5	137	134.5
22	11	210	7	88	81	208	2	17	15
23	3	213	2.5	114	111.5	193	3	21	18
24	5	231	-	-	-	278	-	-	-
25	9	168	3	33	30	171	3.5	7.5	4
27	11	218	-	-	-	209	-	-	-
28	6	203	2.5	122.5	120	192	118	120	2
29	12	210	1	122	121	224	1.5	29	27.5
30	1	212	2.5	66	63.5	232	2	80	78
31	7	229	2	131.5	129.5	213	2	99.5	97.5
32	2	204	3	161	158	204	1	121	120
33	5	177	2	153	151	208	2	137	135
34	8	178	2	163	161	170	1.5	3.5	2
35	11	193	-	-	-	217	-	-	-
37	12	176	2.5	14.5	12	173	10	11	1
38	4	239	-	-	-	193	-	-	-
39	10	200	0	0	0	270	3	13.5	10.5
42	12	283	1.5	91.5	90	275	2.5	32.5	30
43	3	221	4.5	121	116.5	190	3	51	48

DATA BY SUBJECT (cont'd.)

Subject #	Stimulus Tape	Third Segment				Fourth Segment			
		Final Rate	Onset Time	Termination Time	Duration Time	Final Rate	Onset Time	Termination Time	Duration Time
44	9	231	10	87	77	230	3	145.5	142.5
45	4	194	3	47	44	215	4	96	92
46	10	200	-	-	-	150	-	-	-
47	8	221	-	-	-	239	-	-	-
48	4	372	11	112.5	101.5	199	1.5	164	162.5
49	10	302	-	-	-	219	-	-	-
50	5	175	-	-	-	150	-	-	-
51	6	191	-	-	-	150	-	-	-
52	9	192	-	-	-	220	-	-	-
53	10	161	2	167.5	165.5	166	7	130.5	123.5

Auditory Learning

The **Consortium on Auditory Learning Materials for the Handicapped** was established in an attempt to tie together those federally funded projects that have a common interest in auditory learning with handicapped children. Activities of the **Consortium** include the development of procedures for identifying and classifying auditory instructional materials, the design and evaluation of auditory instructional materials, and other project activities related to auditory learning.

Members of the **Consortium** include projects at American Printing House for the Blind/University of Northern Colorado/Illinois Instructional Materials Center/University of Nebraska/New Mexico State University/University of Oregon/Pennsylvania State University/ University of Wisconsin/Ohio State University/Michigan State University.

The **Consortium on Auditory Learning Materials** is coordinated at Michigan State University.