Experimental study of the effects of speech delivery rate and speaker sex upon listening achievement of university students

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AN EXPERIMENTAL STUDY OF THE EFFECTS OF SPEECH DELIVERY RATE
AND SPEAKER SEX UPON LISTENING ACHIEVEMENT
OF UNIVERSITY STUDENTS

By
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B.A., University of Montana, 1974

Presented in partial fulfillment of the requirements for the degree of
Master of Arts
UNIVERSITY OF MONTANA
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Date: June 4, 1976
ABSTRACT

Kinghorn, W. D. June 1976 Interpersonal Communication

An Experimental Study of the Effects of Speech Delivery Rate and Speaker Sex Upon Listening Achievement of University Students (47 pp.)

Director: Wesley N. Shellen

126 undergraduate students in Interpersonal Communication courses were each assigned to one of eighteen experimental groups. Each group was asked to respond to a listening comprehension test over the same message, presented at normal rate (175 wpm), 25% compression (233 wpm), or 35% compression (269 wpm) by one of three female and three male readers.

It was hypothesized that: (1) Subject test scores over the message presented at successively higher rates of speech compression would differ from those over the message presented at a normal rate; (2) Subject test scores over the message presented by female readers would differ from those over the message presented by male readers; and (3) an interaction would occur between the effects of rate of presentation and reader sex.

Test scores were analyzed through use of a series of factorial designs to compare the effects of: (1) Rate of message presentation by Sex of Reader; (2) Rate of message presentation by Individual Reader (Female); and (3) Rate of message presentation by Individual Reader (Male).

Results failed to support the hypotheses. Trends were noted for both sexes in support of H1 and favoring male readers in support of H2, but neither result was significant at the .05 level. No significant interaction was found.

The results implied there is no significant difference in the way male or female speech is comprehended regardless of the rate at which information is presented to listeners. Also, results implied the existence of untested contextual variables which may have affected the experimental situation.
ACKNOWLEDGEMENTS

Generous assistance from many people has contributed heavily toward the satisfactory completion of this study. Several persons, however, deserve special recognition.

My thanks to: Dr. Wesley N. Shellen, committee chairman, for his direction and counsel; Ms. Sara McClain for her expertise in speech pathology; Dr. Duane D. Pettersen for his help in the areas of speech-rate control and human information processing; and Dr. William W. Wilmot, Dr. James Polsin and other faculty and staff members in the Department of Interpersonal Communication, University of Montana, who offered suggestions and who made available volunteer students from their classes for experimental subjects.

My greatest appreciation I reserve for my wife, Joy, who not only assisted me with the experiment and typed the manuscript, but also provided me with understanding and encouragement during some unusually trying circumstances.
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CHAPTER I

STATEMENT OF THE PROBLEM AND REVIEW OF LITERATURE

The Problem

The effect of speech compression upon human listening behavior has received considerable empirical attention. Fairbanks et al. (1957) and later Foulke et al. (1962) found speech comprehension to be relatively unaffected at presentation rates of up to twice normal rate (50% compression). The findings of Marsh (1973) agreed with the earlier studies until a particular presentation rate was reached, whereupon a significant decline was observed. This point of decline tended to vary relatively little with different subjects. Foulke & Lass (1973) found a nonsignificant tendency for listening behavior to decline. Figure 1 is a presentation of the results of the Foulke & Lass study, illustrating a decline in overall listening behavior with increasing presentation rates.

![Figure 1](image)

Mean scores for listening behavior (from Foulke & Lass, 1973)
Rossiter (1974), through his study, did find a significant decline in listening behavior. Figure 2 represents the results of the Rossiter study, and illustrates this decline in listening behavior which he found.

![Graph](image)

Figure 2

The listening behavior means of Rossiter's experimental groups. (From Rossiter, 1974, p 761)

Zemlin et al. (1968), in studying the difficulty of listening to compressed speech, had found a definite increase in comprehension difficulty with increasing rates of compression, a finding which was not strongly supported by the more recent studies mentioned above. Factors such as sex-related voice characteristics and processing artifact which were little noticed by earlier researchers have continued to come to light and have become areas of attention in recent studies due to the possibility of their contributing to listening difficulty.

Foulke (1966) conducted a questionnaire survey and determined that a majority (64%) of listeners preferred to listen to time compressed male speech although in response to another survey including the same question a majority preferred time compressed female speech. In the
Zemlin et al. (1968) study, which also explored the question of the relative difficulty of comprehending male and female voices in compressed speech, it was found that, while nearly identical with male voices at low compression levels, female voices tended to diverge steadily at higher rates of compression, with the female voice displaying greater values of listening difficulty. Figure 3 illustrates this divergence.

![Figure 3](image_url)

**Figure 3**

Mean scaled difficulty (divided by 10) of male and female speech for various degrees of time compression. Each datum point is the mean for 20 raters. (From Zemlin, et al., 1968, p 878)

A more recent study by Foulke & Lass (1973), however, showed a preference for male readers, although this preference was not found to be statistically significant. They did find a statistically significant interaction between word rate and speaker sex.

It was the purpose of this study to investigate the effects of speech delivery rate and speaker sex upon listening achievement in the environment of an instructional listening laboratory.
Discussion and Review of Literature

Williams (1972) defines speech as language performance, the complex combination of many factors, of which language is but one. Flanagan, (1965) remarked that, since man was constructed to live in an atmosphere, it is not unnatural that he should learn to communicate by using the collision of air molecules. To arbitrarily limit man to mere verbal language is to ignore reality, of course, since non-verbal language makes up a significant portion of human communication, (Mehrabian, 1971). For the purpose of this study, however, we shall be discussing verbal language, since it is that medium, primarily, with which we deal in speech-rate control.

In order to more fully understand the complex process of speech-rate control it is first necessary to understand the fundamental components of speech. Speech may be considered to consist of phonemes, or meaningfully distinctive sounds of speech. The English language, for example contains some 42 phonemes which include vowels, consonants and diphthongs. Of these 42 phonemes, through ordered selection, an individual organizes those which comprise the combinations or words which he uses to express the information which he wishes to communicate.

It is significant to note that approximately 10 phonemes are uttered per second in normal conversational speech, each phoneme containing the equivalent of approximately 5 bits of written information. Normal speech, then, contains a maximum written equivalent of 50 bits of information per second. Shannon and Weaver (1949) demonstrated that a continuous information transmission channel can accommodate a maximum error-free data range of from 30,000 to 36,000 bits per second, a rate
which is six- or seven-hundred times the written equivalent of human speech.

A number of questions are immediately raised regarding the channel capacity discrepancy. Does spoken language contain vastly more information than it does when written? Can the human receiver accommodate the greater amount of information, or does he discard most of the information he receives?

Human channel capacity and information processing are among the areas which have received, and are yet receiving, considerable attention. There is evidence to support variance in individual human channel capacity as the environment of the individual changes, (Kernon & Mojena 1973). The capacity of an individual to utilize information entering his channel has been shown to vary among individuals and to vary with changes in the human organism and in its environment, (Marsh, 1974; Schroder, et al. 1965).

It is evident, however, that the spoken information contains somewhat more information than does the written equivalent. Just how much more is contained in the spoken message seems still to be in question due to difficulty in arriving at an objectively evaluative reference base, (Weaver & Weaver, 1965). The highly transitory nature of the spoken message, as it is most often used, does not permit an absolutely accurate contextual recall of the information for review.

The single-channel capacity bit rate of Shannon and Weaver referred to an error-free rate which was obtained at a 30-db signal-to-noise ratio, or an equivalent signal-to-noise ratio of 31.6 to 1. Most listeners intuitively recognize the benefits to communication obtained
from selecting a quiet room for that purpose as opposed to a noisy, crowded room or to a noisy factory. Less evident is extrinsic noise caused by an environment in which the receiver (or the speaker, for that matter) is physically uncomfortable, or where he is emotionally stimulated or distressed. To further reduce the signal-to-noise ratio, such factors as inarticulate or imperfect speech and excessively high- or low-pitched voices add noise to the message. Also, colloquialisms or jargon tend to increase information density without providing a corresponding equivalent increase in signal-to-noise ratio.

To permit the effects of voice and, ultimately, the speech-rate control process upon speech to be understood, speech must be further elementized from its phonemes into the waveform patterns of which phonemes are formed, and then into the wave combinations which are combined to form waveforms. A complex waveform of the vowel /a/, a phoneme in the English language, is shown in Figure 4. The horizontal axis represents time, the vertical axis represents amplitude. The time period d is repeated 3 times, each time period containing a complete cycle of the complex waveform which represents the phoneme. The number of cycles of the complex waveform which are generated in actual speech is dependent upon the frequency of each of the individual waves which combine to form the complex waveform and upon the length of time the phoneme is uttered.

Figure 5 is an example of how simple sine-function or pure-tone waveforms combine algebraically to form a more complex waveform. It should be noted that wave A produces twice as many cycles during time d as does wave B. When the two waveforms are combined, the amplitude
The complex waveform of the vowel /a/ spoken and maintained. (From Williams, 1972, p 12)

of wave C is determined by the algebraic sum of the two waves A and B at any point along the time axis.

Simple wave combination. (From Williams, 1972, p 13)

Figure 6 shows a graphic analysis of a wave having a fundamental frequency of 100 cycles per second plus the harmonics A and D as shown. The resultant waveform of Figure 6 is obviously a significantly more
complex waveform than that of Figure 4, yet the same algebraic summation of the individual waves is used to produce the resultant complex waveform.

![Diagram of waves](image)

**Figure 6**

Graphic analysis of wave. (From Williams, 1972, p 15)

To this point two important speech environment factors have been discussed to which attention must be paid when undertaking to effect speech-rate control upon a message. These are the primary factors: speech waveform complexity and waveform redundancy. It is important to recognize that redundancy in the complex waveform, while sometimes important in conveying secondary information such as emphasis, emotion, etc., is information superfluous to intelligibility once the phoneme has been recognized by the receiver. Also, much of the harmonic information contained in the complex waveforms serves only to identify individual voice characteristics and, again, to simply express emotion or emphasis.
Modern high frequency voice communication systems, using techniques pioneered by Bell Telephone Laboratories, demonstrate that speech bandwidth can be reduced to a range of from 350 hertz to 3500 hertz while maintaining both intelligibility and sufficient individual speech characteristics to retain the identity of the speaker. A further reduction in bandwidth of from 500 hertz to 2500 hertz retains conversational intelligibility, but results in the loss of most voice characteristics identifiable with the speaker.

Female voices suffer greater loss of natural characteristics from bandwidth reduction at these frequency ranges. From Figure 7 it can be seen that female speech energy does not begin to exceed that of male speech until slightly above 4000 hertz. If the upper frequencies are lost through filtration, female voices will be the more affected.

![Figure 7](image)

**Figure 7**

Long time power density spectrum for continuous speech. (From Malmberg, 1968, p 37)
Zemlin (1967) found indication that recognition of speech material is dependent upon frequency patterns rather than upon frequency distribution. Modifications to speech which result in frequency shifts beyond a certain amount tend to exceed the range which the listener has come to accept and recognize as natural and normal because of previous knowledge of language and his common experience with human speech. When this experiential realm is exceeded, intelligibility suffers.

To more fully understand how speech bandwidth and redundancy affect speech-rate control some of the fundamental facts of speech rate processing must be understood. Schiffman (1974) explained the procedure used by his Variable Speech Control system as illustrated in Figure 8. This system, by using a unique technique, essentially produced the same expansion/compression product as do most other systems in use.

A sound transcription when replayed at normal speed, as in Figure 8.1, sounds normal to the ear. The rate of information delivered to the ear can be doubled, however, if the playback rate is doubled, as in Figure 8.2. Unfortunately, doubling the presentation rate with this method results in the voice of the person speaking being reproduced at an abnormally high-pitch as it is delivering the message. This is sometimes called the "Donald Duck" effect. Although listeners can become accustomed to this abnormal voice pitch, it is an annoying handicap to effective information flow. Campanella (1967) describes the problem as one in which the speeded-up speech spectrum pattern exceeds the relatively fixed range of frequencies over which we have learned to recognize normal speech. The alternative to Figure 8.2 which has proven most effective is that of removing segments of the
information to form a restored information train which is now some fraction of its original length as in Figure 8.3. This process has usually been referred to as "time-compressed speech" or simply "compressed speech," and is illustrated in Figure 9.
Because the re-connected information is replayed at the same rate at which the original phonemes were uttered, they retain essentially the same frequency characteristics which they had at that time. What has happened, however, is that some of the redundant phonemic information has been removed, allowing a greater number of phonemes to be delivered in a given time.

Since much of normal speech is comprised of pauses and sometimes meaningless phrases used by speakers to retain conversational control while searching for thoughts and words, it would seem the more of this seemingly useless material which can be eliminated, the better. In fact, however, some pauses contribute significantly to speech comprehension. Johnson and Friedman (1971), in studying the effects of temporal spacing on listening comprehension, found phrase spacing to
have a consistently greater effect on comprehension test scores than did clause spacing. That is, messages were more accurately understood when temporally spaced at phrase boundaries within rather than between sentences, or where no spacing was used at all. Two possible explanations may be offered: the spaces may provide perceptual processing time for the listener, or they may serve to act as boundaries for syntactic recognition. In either case, pauses cannot be completely eliminated without a resulting detrimental effect upon listener comprehension.

The process of speech compression can be reversed in order to produce a lengthening of the time period during which the phonemes are uttered. This process, described in Figure 10, is used as a diagnostic aid to selectively evaluate delivery and pronunciation, etc., in some areas of speech pathology, and in the study of musical forms.

Figure 10

Expanded information. Slower than normal playback without pitch distortion is accomplished by inserting gaps that, in effect, compress the waveform.

(From Schiffman, 1975, p 93)
At first glance, it would seem logical to assume that any voice processed by a speech-rate controller would remain that same voice in reproduction, accelerated or slowed in delivery rate according to the type and amount of processing to which it is exposed, thus to be as understandable as before. Unfortunately, this is not necessarily the case. Foulke & Lass (1973) found that the voices of professional readers produced the best listener comprehension, with good experienced readers and inexperienced readers successively less effective, regardless of speech-rate compression levels. Male voices tended to produce better listening comprehension than did female voices, but the difference was not found to be significant. Comprehension was assessed by means of a multiple-choice test over the content of the selections which were read.

These findings supported those of Zemlin et al. (1968) who showed that listeners found female compressed speech to be more difficult to listen to than male compressed speech. Foulke (1966) had earlier found a majority among one group of blind subjects who regularly listened to compressed speech recordings which preferred the female voice to the male voice (55% vs 45%) because it was easier to understand. A greater majority in another study, however, preferred to listen to the male voice (65% vs 32%). Beasley and Zemlin (1967) suggested the necessity for further study to examine speaker sex preference in light of a possibility that the female voice has an intrinsic advantage when processed in time-compressed speech.

As can be seen, the results of research to this point lack the depth necessary to make a strong case for the existence of a speaker
voice preference for either sex or for a complete absence of such a preference. Previous studies have raised questions concerning the existence of factors which were unknown to or ignored by researchers and which have contributed to the disparity in study results.

Experience with the Graham Fairbanks-type speech-rate controller at the Department of Interpersonal Communication, University of Montana, has shown no definite preference for male voices as compared with female voices of similar training. Voices which contain significant speech artifact (i.e. lisping, drawled phrases, imprecise pronunciation, high resonance, breathiness, false pitch etc.) however, have been found to be lacking in quality when speech-compressed. In general, these voices which conform to the optimum voice-quality parameters mentioned later have been found to produce more satisfactory results when speech-compressed than do those which do not.

Information obtained from the 1958 Bell Telephone Laboratory recording "The Science of Sound" provides some clues to the reasons for processing difficulty with some voices. Because the procedure of arbitrary sampling of the speech information, as used in speech-rate processing, is independent of the natural amplitude variations of the phonemes, no naturally logical meaning can be assigned to the sampling pattern which is necessarily superimposed upon the reconstructed information. What usually remains is an echo or reverberation effect called "sidetone noise" which is annoying, at best, and adds significantly to processing noise.

Bell Laboratories explained that the reverberation or echo effects can be quite detrimental to speech comprehension. In some speech-
rate processing systems there seems to be a significant distortionproducing echo effect. The non-availability of equipment at this time has prevented an accurate analysis of this problem.

Wright (1973) concluded that: "Sidetone noise seems to be one inhibiting factor in the comprehension of compressed speech, at least at moderate compression rates." He recommended that speech rate changers be modified to incorporate sidetone filters.

Of particular interest to the problem of speech-rate processing of female voices, which are normally higher-pitched than male voices, is the masking effect produced by a given tone upon one at a higher, frequency. A tone can successfully mask a higher tone of much greater amplitude with greater effect occurring with increasing frequency separation between tones. This would tend to cause the sampling-rate background in the processor to mask female voices to a greater extent than it does male voices.

Wright studied the effects of sidetone interference at time-compressed presentation rates of 75% and 60%. At the lower compression rate the effect of filtering the sidetone was to significantly improve listener performance as measured by the STEP listening test. The higher rate produced no difference between filtered and unfiltered presentations which showed the comprehension factor produced by filtration to out-weigh the intelligibility factors resulting from time compression.

Speech redundancy tends to be lost during time-compression of speech as a product of the discard interval involved. Because of this loss of redundancy, the retained information becomes the more masked
by the effects of noise and distortion. Cramer (1967) has cited empirical evidence that at least one means of producing optimum intelligibility is to tailor the length of the discard interval to the compression rate. In this way the discard interval becomes shorter as the compression rate increases, and the phonemic information necessary to intelligibility is less likely to be lost in the discard. Reducing the length of the discard interval and increasing its frequency makes the sampling sidetone less objectionable.

Cramer, himself, pointed to 15 milliseconds as the near ideal discard interval for all compression ratios since that interval would insure, on the average, at least one complete voice pitch period in each speech sample down to fundamental voice ranges of about 67 hertz. His work has shown that samples of half a pitch period will simply double the pitch of the voice so processed as though the voice was being reproduced at twice normal speed. This would indicate that speech is mentally processed over intervals of a pitch period, and that pitch is perceived as a function of time between fundamental cycles without regard to half-cycles.

A soprano voice having approximately twice the frequency of an average male voice would be twice as redundant as the male voice, and could be expected to tolerate discard intervals of one-half the optimum for the male voice without encountering the pitch-period problems mentioned above. In this way, the female voice should evidence a superior quality when time-compressed, particularly at the higher rates. Unfortunately, in addition to the problems which were previously mentioned, the female voice has usually been processed through
equipment which is either optimized for male voices or else allows
a limited control of the discard interval length.

Another factor affects time-compression of voices as much, if
not more, than any other. Persons whose voices are generally con-
sidered to be most listenable, particularly those who are employed
in broadcasting or in the preparation of materials for use by the
reading handicapped, are found to have wide variations in their funda-
mental voice frequencies. These voice variations may be acquired by
these persons to add color and expression to their voices. Foulke
et al., (1962) and Cramer (1967) found voice fundamental frequency
variation of ± 5% in male voices to compress well, while variations
of ± 25% did not.

Summary

Researchers, in studying the effects of speech-rate compression
upon listening comprehension, have apparently failed to reach a con-
census concerning the results of their experimentation. There is some
agreement that a decline in listening behavior takes place as presenta-
tion rates are increased, but the rate of decline and the point at
which significant decline takes place remain relatively unclear. It
would seem that the factors which affect listening behavior are strongly
contextual in nature.

There has been evidence suggested by Foulke (1966), and others,
that listening behavior may be affected by a listener preference for
a certain reader sex. No clear consensus of opinion stands on either
side of this question. Cramer (1967) described speech characteristics
which tend to favor female speech, lending more support to the Foulke finding. Some further information (Wright, 1973) offers evidence that the process of speech-rate compression to effect higher presentation rates may, in itself, contribute to conditions which may affect male and female voices differently.

Certain voice-quality parameters are important for clarity of speech for both sexes when the speech is to be speech-rate processed. The natural advantage which female voices seem to possess in terms of intelligibility may actually be reduced to a disadvantageous position when processed via some types of equipment (Cramer, 1967).

Foulke & Lass (1973), in a study of listening behavior at increasing presentation rates using both male and female readers, found a slight, but nonsignificant, preference for male readers. These results seem to suggest that some processing artifact may have altered the relative effectiveness of the two groups of readers.

Statement of Hypotheses

This study was planned to investigate the effects of the two variables speech delivery rate and speaker sex upon listening achievement. As a result of reviewing other studies involving these variables and their effects upon listening achievement, the following generalities are posited: (1) subject listening achievement performance will change as information presentation rate is increased; and (2) subjects listening to female readers will differ in listening achievement performance from those listening to male readers. From these generalities the following hypotheses are posited for purposes of this study:
I. Subjects who hear a message presented at successfully faster compressed-speech presentation rates will have scores significantly different on a listening achievement test over the contents of the message from those who hear the message at a normal rate.

II. Subjects who listen to a message presented by female readers will have scores significantly different on a listening achievement test over the contents of the message from subjects who listen to the message presented by male readers.

III. A significant interaction will occur between the effects of rate of presentation of a message and reader sex as determined from scores of a listening achievement test over the contents of the message.
CHAPTER II

METHOD

Subjects

The subjects used for this experiment were 126 student volunteers taken from undergraduate courses in the Department of Interpersonal Communication at the University of Montana during spring quarter of 1976. Subjects were screened by questioning to eliminate those with serious hearing difficulties which would affect their hearing the message, and to eliminate those who had been previously exposed to the listening behavior test used or to any adaptation thereof.

The sample taken consisted of 58 females and 68 males divided among the classes shown in Table 1.

<table>
<thead>
<tr>
<th>Class Standing</th>
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<tr>
<td>Sophomore</td>
<td>34</td>
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<tr>
<td>Junior</td>
<td>21</td>
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<tr>
<td>Senior</td>
<td>34</td>
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<tr>
<td><strong>Total</strong></td>
<td>126</td>
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</table>
The schools and colleges represented in the sample are shown in Table 2.

TABLE 2

<table>
<thead>
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<th>Distribution of subjects by school and college enrollment</th>
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<tr>
<td>College of Arts &amp; Sciences</td>
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<td>School of Business Administration</td>
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<tr>
<td>School of Education</td>
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<tr>
<td>School of Fine Arts</td>
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<tr>
<td>School of Forestry</td>
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<tr>
<td>School of Journalism</td>
</tr>
<tr>
<td>General Studies</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

Readers

The readers selected for this experiment were drawn from a group of experienced readers who have served as readers for radio station KUFM at the University of Montana. Three female readers and three male readers were selected.

Materials

The materials used in this experiment included a tape-recorded message and a test of listening comprehension over the contents of the message.
The Message

The message chosen for use in this experiment is an adaptation of the standard message used in the lecture comprehension section of the Brown-Carlsen Listening Comprehension Test. It consists of 1875 words and can be read by moderately-skilled readers at approximately 175 words per minute. The message was prepared for delivery at a normal rate of 175 words per minute, and at compressed rates of 233 words per minute (25% compression) and 269 words per minute (35% compression). A copy of the message with related instructions is included as Appendix A.

The Listening Comprehension Test

The listening comprehension test is an adaptation of the test used with the lecture comprehension section of the Brown-Carlsen Listening Comprehension Test. The test consists of twenty-one questions testing the recall of facts, ideas, and inferences found in the message. Response to the questions consists of selecting the correct choice from five possible answers to each question as listed on a prepared answer sheet, and marking the appropriate answer space for that choice. A copy of the test questions with related instructions is included as Appendix B. Reliability data on the Brown-Carlsen Listening Comprehension Test is included as Appendix C.

Procedures

The procedures used in this experiment will be described in terms of (1) selection of subjects and (2) administration of the experiment.
Recruitment of Subjects

With the permission of the respective instructors, students in Interpersonal Communication courses conducted during spring quarter 1976 were asked to volunteer for participation in the experiment. The courses involved and the number of students participating from each class are shown in Table 3. The choice of courses and the numbers of students participating from each resulted from the enforced constraints of availability of student volunteers and availability of the listening laboratory facilities.

**TABLE 3**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Participants</th>
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<tbody>
<tr>
<td>INCO 111</td>
<td>Introduction to Public Speaking</td>
<td>39</td>
</tr>
<tr>
<td>INCO 112</td>
<td>Rational Decision Making and Advocacy</td>
<td>23</td>
</tr>
<tr>
<td>INCO 118</td>
<td>Oral Expression</td>
<td>31</td>
</tr>
<tr>
<td>INCO 234</td>
<td>Intro. to the Process of Communication</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>126</strong></td>
</tr>
</tbody>
</table>

Preparation of Materials

Particular care was taken to maintain maximum audio quality for each recorded message in order to prevent introduction of artifact into the experimental data. For this reason, the highest quality equipment available to the experimenter was used for this experiment. Descriptions of equipment configurations used in the production of the message tapes used in this experiment are included to more clearly describe the process involved.
Each reader was given a copy of a script containing the message, carefully annotated for timing, and a copy of a script containing instructions related to the message, instructions related to the test questions, and the test questions. Each reader recorded the scripts on a master tape using the audio production facilities at KUFM. Figure 11 describes the equipment configuration used to produce the tapes.

![Diagram](image)

**Figure 11**

Equipment configuration used to produce master tape recordings at 7.5 ips

The messages prepared by the readers were duplicated at a speed of 3.75 ips to be compatible with the speech compression equipment in use in the Department of Interpersonal Communication. Figure 12 describes the equipment configuration used to duplicate the message.

Following preparation of the six master tapes at 3.75 ips, each tape was processed through the Discerned Sound Co. Whirling Dervish speech-rate controller at compression rates of 25% and 35%. The messages were re-recorded from the Dervish at a tape speed of 7.5 ips. The equipment configuration used in processing the information through the speech-rate controller is shown in Figure 13.
Figure 12

Equipment configuration used to produce master tapes at 3.75 ips

Figure 13

Equipment configuration used to compress message tapes

Each of the final 18 message tapes was produced by combining a message recording with recorded instructions and test questions, then two cassette tapes of each were recorded. Figure 14 describes the configuration used to produce the cassette tapes.
Equipment used in the preparation of the audio tape recordings was maintained according to manufacturers' specifications for broadcast service wherever possible. The Discerned Sound Co. Whirling Dervish was calibrated for operation in accordance with its manufacturer's instructions.

**Administration of the Experiment**

In order to make maximum use of the available subjects it was determined to utilize the listening laboratory facilities available in the Department of Interpersonal Communication. The laboratory presently can accommodate up to nineteen subjects at one time.

A pilot study using 60 University of Montana undergraduate students was conducted during autumn quarter, 1975, to explore the possible existence of experimental artifacts resulting from a "crowd effect" when using a classroom environment for this type of experiment, or from an "isolation effect" when using a listening laboratory. The results of this study showed no significant difference between the two environments regardless of whether the subjects were listening to speech presented at normal rates, or to compressed rates. Based on the results of this study, it was determined that the choice of the listening laboratory as the environment for this experiment would result in greater experimental efficiency, and would likely produce no experimental artifact in itself.

The equipment in use in the listening laboratory consists of nineteen operational audio carrels, each equipped with a Sony Model EP-740 Booth Recorder and a Sony Model HS-27C headset.
Experimental materials consisting of (1) a pre-recorded cassette tape containing a message with instructions for its use and for administration of the test and, (2) a test booklet, were given to each subject as he entered the laboratory. A copy of the test booklet is included as Appendix D. Each tape recording contained the same material, differing from others only in the particular reader's voice used in its preparation, and in the presentation rate used for the message.

In order that any number of subjects could be tested at any one time within the capacity of the laboratory, each set of materials was initially randomly assigned to one of the eighteen test cells, and a message appropriate to that cell was included. As each subject received his materials, he simultaneously received a random assignment to a test cell.

Upon receiving a set of materials, the subjects were directed to listening booths and were asked to begin by following the directions printed on the test booklet covers. The subjects were carefully monitored to enable the experimenter to answer questions and to provide assistance when needed.

Following completion of the experiment by each group of subjects, test materials were recovered and the tests were scored. Scores were then tabulated for subsequent analysis. In compliance with the policies of the Department of Interpersonal Communication, test scores and experimental results were made available to subjects upon request.
CHAPTER III

RESULTS

This chapter contains the analysis of the data collected in the experiment. The .05 level of significance was required and is reported.

Subject responses to the listening achievement test were scored manually by use of a set of scoring overlays, and the number of correct responses was entered on the cover of each booklet. Test scores were then tabulated according to test cell assignment. Computer data cards were punched, each card containing the individual scores representing one test cell. Table 4 shows test mean scores at each presentation rate used.

Achievement test scores were analyzed using the Ulrich-Fitz analysis of variance computer program called from the University of Montana Computer Center program library. The data was arranged in a series of factorial designs as follows:

1- Rate by sex  
   3 x 2 factorial ANOVA

2- Rate by Reader (Female)  
   3 x 3 factorial ANOVA

3- Rate by Reader (Male)  
   3 x 3 factorial ANOVA

The Rate by Sex 3 x 2 factorial ANOVA source table is presented in Table 5.
TABLE 4

Experimental Test Mean Scores

<table>
<thead>
<tr>
<th></th>
<th>175 wpm</th>
<th>233 wpm</th>
<th>269 wpm</th>
<th>Reader Total Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Rdr #1</td>
<td>10.43</td>
<td>11.29</td>
<td>11.00</td>
<td>10.90</td>
</tr>
<tr>
<td>Female Rdr #2</td>
<td>14.43</td>
<td>11.71</td>
<td>12.57</td>
<td>12.90</td>
</tr>
<tr>
<td>Female Rdr #3</td>
<td>14.14</td>
<td>11.29</td>
<td>12.43</td>
<td>12.62</td>
</tr>
<tr>
<td>TOTAL FEMALE MEANS</td>
<td>13.00</td>
<td>11.43</td>
<td>12.00</td>
<td></td>
</tr>
<tr>
<td>Male Rdr #1</td>
<td>12.29</td>
<td>12.42</td>
<td>12.29</td>
<td>12.33</td>
</tr>
<tr>
<td>Male Rdr #2</td>
<td>13.00</td>
<td>13.43</td>
<td>11.86</td>
<td>12.76</td>
</tr>
<tr>
<td>Male Rdr #3</td>
<td>14.00</td>
<td>12.57</td>
<td>11.57</td>
<td>12.71</td>
</tr>
<tr>
<td>TOTAL MALE MEANS</td>
<td>13.10</td>
<td>12.81</td>
<td>11.90</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 5

Rate by Sex 3 x 2 factorial ANOVA source table

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>MS</th>
<th>df</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>29.25</td>
<td>14.63</td>
<td>2</td>
<td>2.12</td>
<td>0.122</td>
</tr>
<tr>
<td>Sex</td>
<td>6.67</td>
<td>6.67</td>
<td>1</td>
<td>0.97</td>
<td>0.671</td>
</tr>
<tr>
<td>Interaction</td>
<td>13.54</td>
<td>6.77</td>
<td>2</td>
<td>0.98</td>
<td>0.620</td>
</tr>
<tr>
<td>Within</td>
<td>228.00</td>
<td>6.90</td>
<td>120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of this ANOVA show no significant effects for variations in presentation rate, variations between speaker sexes, or for the interaction between presentation rate and speaker sex.

Table 6 contains the source table for the Rate by Female Reader 3 x 3 ANOVA. The ANOVA showed no significant effect for variations
in presentation rate with female readers, but the main effect representing female readers was found to be significant. No significant interaction between presentation rate and female readers was found.

**TABLE 6**

**Rate by Female Reader 3 x 3 factorial ANOVA source table**

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>MS</th>
<th>df</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>26.57</td>
<td>13.29</td>
<td>2</td>
<td>1.91</td>
<td>0.156</td>
</tr>
<tr>
<td>Female Readers</td>
<td>49.14</td>
<td>24.57</td>
<td>2</td>
<td>3.53</td>
<td>0.035</td>
</tr>
<tr>
<td>Interaction</td>
<td>32.00</td>
<td>8.00</td>
<td>4</td>
<td>1.15</td>
<td>0.343</td>
</tr>
<tr>
<td>Within</td>
<td>516.00</td>
<td>6.96</td>
<td>54</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7 contains the source table for the Rate by Male Reader 3 x 3 ANOVA.

**TABLE 7**

**Rate by Male Reader 3 x 3 factorial ANOVA source table**

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>MS</th>
<th>df</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>16.22</td>
<td>8.11</td>
<td>2</td>
<td>1.24</td>
<td>0.299</td>
</tr>
<tr>
<td>Male Readers</td>
<td>2.32</td>
<td>1.16</td>
<td>2</td>
<td>0.18</td>
<td>0.840</td>
</tr>
<tr>
<td>Interaction</td>
<td>13.97</td>
<td>3.49</td>
<td>4</td>
<td>0.53</td>
<td>0.716</td>
</tr>
<tr>
<td>Within</td>
<td>354.57</td>
<td>6.57</td>
<td>54</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No significance was shown by this ANOVA for effects of variation of presentation rate or for difference in male readers, and no significant interaction was found.
Figure 15 represents a graphic display of the means of the test group scores in the experiment.

![Graph showing listening behavior means for experiment.](image)

**Figure 15**

Listening behavior means for experiment.
CHAPTER IV

DISCUSSION

The results presented in Chapter III have been discussed in this chapter in their relationship to the hypotheses tested in this study. The implications of this study for further research in listening achievement and the conclusions drawn from this study have also been discussed.

Test of Hypotheses

The first hypothesis stated:

Subjects who hear a message presented at successively faster compressed-speech presentation rates will have scores significantly different on a listening achievement test over the contents of the message from those who hear the message at a normal rate.

The null hypothesis regarding the effect of increased message presentation rates could not be rejected ($F = 2.12$ with df 2, 120; $p > .05$). Increasing presentation rates produced a continuing, but nonsignificant, decline in listening comprehension. It would appear that subjects were capable of responding to much higher rates of presentation before significant decline in listening comprehension would have taken place.

The second hypothesis stated:

Subjects who listen to a message presented by female readers will have scores significantly different on a listening achievement test over the contents
of the message from subjects who listen to the message presented by male readers.

The null hypothesis related to reader sex could not be rejected ($F = 0.97$ with df 1, 120; $p > .05$). A trend favoring male readers was observed, but it was nonsignificant. This was most likely due to the cumulative factors affecting the aggregate performance of the group of subjects assigned to a particular female reader than to sex related factors. It should be noted that the Rate by Female Reader ANOVA produced a significant main effect for Female Readers ($F = 3.53$ with df 2, 54; $p < .05$), which supports this conclusion.

The third hypothesis stated:

A significant interaction will occur between the effects of rate of presentation of a message and reader sex as determined from scores on a listening achievement test over the contents of the message.

The null hypothesis regarding this interaction could not be rejected ($F = 0.98$ with df 2, 120; $p > .05$).

Conclusions

Results of this study, in failing to reject the first null hypothesis, fail to agree with the results of studies conducted by Possiter (1974) and Zemlin, et al. (1968) which showed significant declines in listening comprehension due to increasing information presentation rates. Results of other studies, most notable Marsh (1976, 1973), Foulke & Lass (1973), Foulke (1962), and Fairbanks, et al. (1957), agree with those of the present study.

While the reasons for the disagreement between the two sets of empirical results remain unclear, the possibility exists that there
are certain variables which have not been properly considered by experimenters in studying listening comprehension which may have affected the experimental results. Such variables may include a high interest in the experiment by the subjects, or their having special interest in the message or a heightened general knowledge concerning the subject of that message.

Shellen (1973) found that subjects who had rated a message interesting performed better on a listening test over that message than those who rated the message uninteresting. Subjects who were aware that they would be tested over the contents of the message scored significantly lower than did those who were not only aware that they would be tested, but that their scores would apply to a course grade.

Some research (Atkinson, 1958) has indicated that a challenge to a subject enhances the desire for success by that subject on projects. Locke (1968), in discussing motivation, said that individual performance is dependent upon individual needs and the level of individual goal commitment toward meeting those needs.

Several experimenters, including Marsh (1976, 1973), Rossiter (1974), and Foulke & Lass (1973), have chosen multiple message formats for their studies. Such use of a variety of topic areas in a message format would tend to reduce the effects of prior knowledge or special interest. The effectiveness of multiple message formats tends not to be entirely conclusive, however. The results obtained by Rossiter (1974) and Foulke & Lass (1973) using multiple messages to study listening behavior at increasing presentation rates tend to be contradictory.
The Rossiter (1974) study, in discussing subject listening performance in the areas of recall of facts, ideas, and inferences, has suggested that message content and testing orientation may be important considerations when message presentation rates are varied. From Figure 2 (p 2) it can be seen that the relationship involving recall of facts, ideas, and inferences, does not remain unchanged with increasing presentation rates. The effect upon recall of inferences appears to be relatively insignificant, while the other areas show marked effects. Obviously, any study which had failed to attend to the relative effect of variations in presentation rates upon these listening comprehension areas would have failed to control for an important potential source of error variance.

Another variable which is highly situational in nature is that of the relationship of testing schedules with the academic and social calendars used by the populations from which subjects are drawn. The effects of this variable and other social factors may differ from study to study. The effects of these variables upon individual subjects would be properly controlled through random assignment of subjects to experimental test cells. The effects of these variables upon different populations from which study samples have been drawn, however, is much more difficult to control since there can be no random assignment of subjects to these populations. Due to time and distance, the particular populations involved may have experienced widely differing social climates.

No less important to the results of this study than previously mentioned variables which seem to affect subjects are the technical
requirements for audio reproduction which is free from processing artifact at all presentation rates. It would be extremely difficult to make an accurate evaluation of the relative levels of audio quality maintained in previous studies. It is not difficult, however, to document the substantial improvements in equipment and technique during the past two decades which have resulted in considerable improvement in audio quality in experimental configurations such as have been used in previous studies. Under these circumstances it would not be unrealistic to suspect that some earlier studies which show significant declines in listening behavior with increasing presentation rates may be seriously affected by loss of audio quality. This would be particularly true of those studies made prior to the past decade.

During the review of literature discussed in the first chapter, some elements of human information processing were mentioned relative to their effect upon listening comprehension. Marsh (1976) presented evidence to support the premise that integration of information may remain stable over a wide range of complexity levels until a critical point is reached. This point, determined by a sharp decline in information integration, has been shown to vary somewhat from person to person and from subject area to subject area. These variations, while not shown to be particularly significant, may provide a clue to the reason for the differences in experimental results.

Fortunately for the experimenter, partial data from a study of information processing and listening achievement made by Dr. Duane Pettersen from the Department of Interpersonal Communication at the University of Montana was made available. This data, which consisted
of Ret test scores (Kelly, 1955) obtained from a group of subjects who also were participants in the present study and their scores on the listening behavior test taken for this study, has produced some interesting results.

Eighteen subjects were involved and were classified into three nearly equal-size groups according to listening test scores as indicated: (1) High LTS, mean 16.00; (2) medium LTS, mean 13.00; (3) low LTS, 9.87. Ret test scores for this group were: (1) High LTS, mean 70.83; (2) medium LTS, mean 104.00; (3) low LTS, mean 115.30. (Ret test scores correlate inversely with information integration ability.) The trend indicated by this data suggested that persons who scored higher on the listening behavior test were also those who were capable of higher level information processing.

Marsh (1974) found information integration to be relatively independent of exposure to information and training and, possibly, a more significant factor than either. Failure to consider the relative information integration abilities of individual subjects would appear to contribute heavily to uncontrolled within-groups error variance, and may be partially responsible for lack of agreement among studies involving varying message presentation rates. Because random sampling from the population would likely produce an equal distribution of information integration abilities in each of the experimental test cells, the present study may well have failed to reject the first null hypothesis, in part, due to within-groups error variance resulting when no control was provided for individual information integration levels.
Failure to reject the second null hypothesis implies, on the surface, there is no significant difference between the way listeners process male speech and the way they process female speech. This is supportive of the Foulke & Lass (1973) study, but not the earlier Zemlin et al. (1968) and Foulke (1966) studies.

The results of the present study, with its careful attention to control of audio processing artifact, have raised serious questions concerning the possible effect of audio quality upon the relative effectiveness of male and female voices as studied in the earlier experiments. From the review of literature it was suggested that the female voice possesses a tendency toward superiority in speech effectiveness not supported by some early studies. Indeed, speech by either sex should at least produce equal results, not a male voice preference as was found to prevail among the earlier studies.

For the technical reasons discussed above, if for no others, the possibility would seem to exist that female voices used in message presentations in those studies showing male voice superiority may have suffered excessively from audio quality-related artifact. The results of the more recent studies conducted prior to the present study tend to support this premise.

Failure to reject the third null hypothesis implies there is no significant difference in the way male or female speech is comprehended regardless of the rate at which information is presented to listeners. The absence of significant interaction is not particularly surprising in this case. There may not have been a fair test of interaction since rate of presentation was not a significant variable in this study.
Foulke & Lass (1973) did find a significant interaction between presentation rate and reader sex, however.

It would appear that sex of the reader makes little practical difference to listener comprehension. This finding was shown to be particularly significant since it seems to hold true with increasing presentation rates.

**Implications**

This study has produced more implications for further study than it has produced answers to previous questions. A myriad of factors seem to have affected the experimental subject in his listening environment. Future experimentation in message presentation should attempt to include controls for these situational variables.

Although considerable refinement has appeared in recent studies, much additional effort is required to develop and improve the dependent variables used in studies involving varying information processing environmental complexities. The work by Marsh and others portends great growth potential in this area.

It has become increasingly important to eliminate processing audio artifact from future studies. Significant technological developments have recently appeared in speech-rate processing equipment as described by Foulke (1976). As soon as the new speech-rate compression equipment becomes available, it should be applied with utmost professional care to resolving the effect of artifact upon the reader sex question and upon the presentation rate question.
The effect of human information processing variables upon listening behavior is an especially exciting question. Future research in this area should be most interesting and rewarding.
An experimental study was conducted to observe the effects of speech delivery rate and speaker sex upon listening achievement.

One hundred and twenty-six undergraduate students in Interpersonal Communication courses were each assigned to one of eighteen experimental groups. Each group was asked to respond to a listening comprehension test over the same message, presented at normal rate (175 wpm), 25% compression (233 wpm), or 35% compression (269 wpm) by one of three female and three male readers. The message and test used were adopted from the lecture comprehension section of the Brown-Carlsen Listening Comprehension Test.

A cassette tape recording of the message, the test questions, and appropriate instructions designated for each test cell was included with a test booklet, and the eighteen sets were given random assignments to order of distribution. The study was conducted in the listening laboratory used by the Department of Interpersonal Communication at the University of Montana.

It was hypothesized that: (1) Subject test scores over the message presented at successively higher rates of speech compression would differ from those over the message presented at a normal rate; (2) Subject test scores over the message presented by female readers would
differ from those over the message presented by male readers; and (3) an interaction would occur between the effects of rate of presentation and reader sex.

Test scores were analyzed through the use of a series of factorial designs to compare the effects of: (1) Rate of message presentation by sex of reader; (2) Rate of message presentation by Individual Reader (Female); and (3) Rate of message presentation by Individual Reader (Male).

The findings of this study may be summarized as follows:

Subjects who heard a message presented at successively faster compressed-speech presentation rates did not score significantly different on a listening achievement test over the contents of the message from those who heard the message at a normal rate.

Subjects who heard a message presented by female readers did not score significantly different on a listening achievement test over the contents of the message presented by male readers.

A significant interaction did not occur between the effects of the rate of presentation of a message and reader sex.

The results failed to support the hypotheses. Trends were noted for both sexes in support of H1 and favoring male readers in support of H2, but neither result was significant at the .05 level. No significant interaction was found to support H3.

The results implied there is no significant difference in the way male or female speech is comprehended regardless of the rate at which information is presented to listeners. The results also implied the existence of numerous variables which have not received sufficient previous empirical attention and which may have affected the results of this study and other previous studies.
It was suggested that future research should concentrate on reducing the effect of variables which seem to have created uncontrolled error variance. Many of these variables have been identified, but require further study to identify their effects. Others, having been suspected as contributing to error variance, need further study to confirm or reject their influences.
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APPENDIXES
APPENDIX A

MESSAGE AND RELATED INSTRUCTIONS
PRE-MESSAGE INSTRUCTIONS

Thank you for agreeing to participate in this study. You have been given a test booklet for the Brown-Carlsen Listening Comprehension Test. Please do not make any marks whatever until I tell you to do so.

Fill in your name and the other information called for on the cover of your test booklet. Please do not open the test booklet until instructed to do so. (Pause 60 sec.)

Much of what we learn is obtained by listening. It is just as important to know how well you understand what you hear as it is to know how well you understand what you read. This test will tell how good a listener you are. Is there anyone who cannot hear me clearly?

I shall read you a fairly lengthy selection entitled, "Improving Your Reading Ability." It may seem that I am speaking quite rapidly as I read the lecture. Do not let this disturb you. Simply try to listen as carefully as possible because, after I have finished, you will be asked to answer questions about the selection. Do not take notes on what I read. Just listen carefully. Let us begin.

MESSAGE

Good reading is important for several reasons. First, reading gives power to learn.

When Edison was six years old, he came home from school with a note from his teacher saying that he was incapable of learning.

"Why?" his concerned mother asked the teacher.

"He can't learn to read," replied the teacher.

"I will teach him myself," the mother answered. And she produced a well-known inventor.
Second, one may gain inspiration for his entire life through reading. For example, Lincoln's stepmother was just a homebody, but she inspired and taught the son of her husband and guided his reading. In later years Lincoln wrote, "The greatest book I ever read, you ask me? My Mother."

Reading is important for a third reason—to help people understand their own experience. Louis Untermeyer, writing about how to enjoy poetry says that most young people confronted with a poem make it an academic exercise. These students think their part is to figure out the rhyme and to notice the figures of speech.

Reading poetry is reading not to get information or to notice how words are used, but to understand one's own experience. If the reading can convey to a person something about life that he has not thought, that is enough. He shouldn't ask for more. If he gets the rhyme scheme and the figures of speech, well and good. But if he concentrates on these, he will miss the whole thing.

Here, for instance, is a poem written by Walt Whitman. He called it "When I Heard the Learned Astronomer." Perhaps Walt Whitman had been to a lecture given by one of the well-known astronomers of his day. He had looked at charts and pictures of the very large number of stars in the sky looking like little designs of pin holes in a piece of blue-black paper. The Astronomer had told the audience how large various ones of the pin holes were in reality, and how many years it would take a ray of light from one of them to reach the earth. The lecturer had speculated on the origin of the universe and the number of years before it would be destroyed. The room was warm and stuffy, and
people moved restlessly in their chairs. Whitman had the feeling that all of this knowledge of the lecturer did not seem very profound. And so he wandered out into the clear night air. Later he wrote: "When I heard the learned astronomer/when the proofs, the figures were ranged in columns before me/when I was shown the charts and diagrams, to add, divide, and measure them/when I sitting heard the astronomer where he lectured with much applause in the lecture-room/How soon unaccountable I became tired and sick/Till rising and gliding out I wandered off by myself/In the mystical moist night air, and from time to time/Looked up in perfect silence at the stars."

Finally, reading often will mean the difference between being a boring or an interesting person. Often people may find themselves in company with a group of strangers and cast about for a subject of conversation. Usually the person who has the most interesting things to talk about is the person who has read widely. The little story is told of a particular shoe salesman who found himself at a certain dinner party in the home of one of his prospective clients. His polite hostess seated him on her right and during the dinner, carefully tried one subject after another to interest him.

"Did you see the exhibit of paintings in the museum?" she asked.

No he had not seen the exhibit.

"What do you think the Dodgers will do this season?"

He replied that he seldom followed the sport pages of the daily papers.

"Isn't it appalling about the new income taxes?" asked the hostess.
The salesman was still silent. He had not been following very closely what the new taxes were to be.

The hostess was getting a little desperate. "Have you read about the new varieties of flowers that are being introduced this season?"

Finally, the unread salesman turned to her and said. "Madam, you have been trying to find something to talk about with me. Why don't you try shoes? That is the only subject I really know about."

Now just what can one do in order to improve his reading? What methods will help one to gain skill so that he can be inspired, or interested, or knowing?

Well, first of all, there is the forcing method. A reader can do something to improve himself simply by making himself speed up in his reading. Take the typical case of John Patterson, a farmer in Minnesota. He didn't read much except his agricultural journals. Most of that reading had to be done slowly because he wanted to figure out from the writing and diagrams just exactly how to plow his field or how to construct a chicken brooder. Thus when he read a paper or a magazine story, he tried to read it in the same way. One day he came across a magazine in a barber shop that gave the number of minutes it should take the average reader to complete each article or story. John found that he took far longer than the average. He decided that he would see if he couldn't beat his own record. So he borrowed the magazine. At first he forced his eyes to move so fast that he was not understanding what he read. But soon he could read quickly through an article and still understand most of what was in it. He discovered also that he could read his agricultural journals more
rapidly and still follow the detailed description given. Anyone can do quite a bit to improve his reading just by making himself read faster.

Then there is the observation approach. To read well, people need to know just what happens to their eyes as they read. Sometimes one can sit on the floor in front of somebody who is reading and watch what happens to his eyes. The eyes will appear to move, stop, move, stop, move, stop, and suddenly move back to the beginning of a new line. Some students have said that the eye movements remind them of a typewriter carriage as it moves along and then returns to start a new line. It is obvious that the fewer stops the eyes make on a line, the faster one will read. So it is wise to practice making one's eyes see groups of words instead of usually looking at each word by itself. One recent reading expert suggests the idea of drawing three or four faint lines down a page of print, and that the reader practice reading the printing by fixing his eyes where each line crosses the line of type. After a while he will be able to gradually reduce the number of lines he needs as he increases the number of words his eyes can see with a single stop.

Another thing to practice is a kind of game one can play with billboards or license plates as he is driving. As he glances at a billboard when he drives past, he should see how much of it he can repeat at a glance. We were playing this game one time when we got into a little argument. One person had read, "Use McCleson's aromatic...." And that was as much as he had seen. Another got the next word which he said was soap. But a third member in the car was
sure that the word at the end was soup...not soap. Finally after some
discussion, the driver had to turn the car around and go back so that
the two could check the answer. Such a game is fun; but, more impor-
tant, it trains one to read things quickly and accurately. One
usually has someone to check his mistakes when he is not right.

One summer an ex-school-teacher lived with us who helped us
learn to get the general idea of a piece of reading. Miss Gavigan,
would come to the dinner table with a lot of short articles that she
had cut from the daily newspaper. She had cut off the headline from
each article and put these in a separate pack. While Dad was serving
she would have each of us read one of the articles quickly and then
make up a headline for it. Then we would check to see how close we
had come to the original headline. In that way she got us to read
rapidly and to pick out the most important idea in the piece of reading
as a whole. After a while Miss Gavigan moved to another method. She
cut off not only the headline, but also the first sentence. If an
article is a typical news story, the first sentence, known as the lead
is supposed to summarize all the important information in the rest of
the story. After we had read the clipped article, she would ask us
the traditional lead questions: who? what? when? where? why? This
drill trained us not only in picking out the major ideas, but in
exactness of detail. It was surprising how much our ability in reading
improved through this game that Miss Gavigan had taken the trouble to
prepare.

The last of the five methods that sometimes help to improve
reading is through machines. To use machines, one has to be able to
go to a reading clinic. The most elaborate of the machines is the Metronoscope. It has an opening that will expose one line of print at a time with three shutters that close the opening. These shutters move open and close alternately across the line. The length of time a shutter is open can be controlled by the machine so that the reader, bit by bit, shortens the time it takes him to read a line. The machine has a speed range of from fifteen to fifty lines per minute. Often, through practice on such machines, the reader is able to speed up his eye movements and his reading speed very much.

Machines are usually expensive and are not readily available to most people. It should be remembered, also, that they help those students who are not having really serious reading difficulties. They will increase the speed of the accurate but slow reader, but they will not increase the accuracy of the inaccurate reader. In working with them it is important that students test themselves on the accuracy of their reading as well as drill themselves on the speed of their reading.

So much for the individual methods. Some may want to use just one of them, though it is probable that most should use a combination. It is important, always, to remember that one must use the methods that will give him help with his particular difficulty. If he reads slowly, he uses one set; if he reads inaccurately, he must use another. When one is dissatisfied with the way he reads, and most of us are, he should be sure that he tries to find out just what troubles he is having before starting to practice.
APPENDIX B

TEST QUESTIONS AND RELATED INSTRUCTIONS
POST-MESSAGE INSTRUCTIONS

That is the end of the lecture. Now open your test booklet to page one. (Pause)

Look at the sample. The question is, "What is the title of the lecture?" Decide which of the five choices given is correct. (Pause) Choice "C" -- (Improving Your Reading Ability), is the correct title. Therefore, the answer space filled in is for the correct answer, "C".

Are there any questions? (Pause) Listen carefully; I shall read each question only once. Let us begin.

QUESTIONS

1. What relative of Lincoln was mentioned in the Lincoln story?
2. How old was Edison when his teacher said he could not learn to read?
3. What author wrote about how to enjoy poetry?
4. What did the man at the dinner party sell?
5. What subject did the hostess at the dinner party not bring up?
6. In which state did John Patterson live?
7. In what place did Patterson find an article that helped him?
8. Where did Miss Gavigan give reading improvement drills?
9. What is the first sentence of a typical news story called?
10. The speed range of the reading machine is expressed in terms of the number of what per minute?
11. Which reading improvement method was not given a separate place in the organization of the lecture?
12. The Edison story was used in this lecture to show the importance of good reading for what purpose?

13. The dinner party story was meant to illustrate the importance of reading for what purpose?

14. Which would be the best title for the Miss Gavigan story?

15. What did the discussion of the use of machines to improve reading suggest?

16. From the poem that Whitman wrote, what do you think his opinion of lecturers was?

17. What did the lecture as a whole seem to suggest about learning to read?

18. Which method did the author seem to feel was the best for learning to read?

19. The reference to Lincoln shows how one can gain what from reading?

20. What kind of person do you think Miss Gavigan was?

21. Which part of the lecture was least directly related to the central idea?

That is the end of the test. Go over your answer sheets carefully making sure that each mark is heavy and black. Erase any stray marks not intended for answers.

Thank you again for your participation in this study. Please leave your test materials in the booth when you are finished.
APPENDIX C

LISTENING COMPREHENSION TEST RELIABILITY DATA
Irving Lorge, Professor of Education, and Executive Officer, Institute of Psychological Research, Teachers College, Columbia University, New York, New York.

The Brown-Carlsen Listening Comprehension Test is the first, or very nearly the first, of the tests to evaluate the comprehension of the spoken word. The test contains 76 items grouped into five parts: Immediate Recall (17 items), Following Directions (20 items), Recognizing Transitions (8 items), Recognizing Word Meanings (10 items), and Lecture Comprehension (21 items). Of these five parts, the sections on transitions and lecture comprehension get closest to the evaluation of listening comprehension; the sections on immediate recall, following directions, and word meanings are more like the subtests of well known intelligence tests. Further, the subtests on immediate recall and following directions tend to overemphasize memory for numbers and the numerical ordering of things, and mental arithmetic of a trivial sort. Of the first 37 items, at least 29 are based on numbers.

The genuine invention in the test is the recognition of transitions, i.e., whether a spoken sentence is introductory, transitional, concluding, or none of these. Skill in recognizing transitions can be a significant component in useful listening skills. The longest section of the test is the lecture section—about twelve minutes of continuous discourse followed by questions of reflective, or critical, listening," i.e., questions of general import and influence as well as the usual ones about detail.

The listening test is read by the teacher or the administrator. This tactic obviates the use of tape or record at the expense of lack of control, of rate of presentation or of emphasis, in speaking the stimulus material. The variation from speaker to speaker should affect not only the reliability of the results but also the dependability of the norms.

The authors report good item-test consistency indexes. The criterion, however, overemphasizes the principal component in the total test—and, to the extent that it does, lessens the value of the analysis of listening skills for the making of the separate parts. The current manual reports that the norming group consisted of about 2,000 students at each of four grades: 9, 10, 11, and 12. These 8,000 students, moreover, had been given the Terman-McNemar intelligence test. In view of this large sample with intelligence test scores, it seems strange that the manual makes no reference to the correlations (for these samples) between the listening scores and the Terman-McNemar IQ's. In Table 6, the reported correlations between the Brown-Carlsen test and mental ability are based on samples of sizes from 52 to 150 students, but the correlations are not always based on the total listening score. They are usually given against parts of the listening test, usually early experimental sections. This unusual pattern of reporting is continued for the relation between listening and reading comprehension test results. It is difficult to assess the validity of a listening test except in terms of its relation to reading comprehension or school success—and even then, tests and criteria are saturated with general intelligence. Guidance counselors, indeed, will miss the needed auxiliary evidence on the relation between the difference between reading and listening comprehension scores and intellectual level—evidence which would enable them to make fuller use of the test results.

Within grades reliability, on the basis of within-form (Spearman-Brown) estimates, is about .86, and, on a between-form basis, about .78. The test probably covers too wide a range of grades to be as generally discriminating in grades 11 and 12 as in grades 9 and 10.

Historically, the test represents a first attempt at measuring an important educational objective and component of scholastic success. Especially valuable are the subsections on recognizing transitions and lecture comprehension. If these two parts were extended, they would lead to a more useful evaluation and guidance test. It is hoped that the test will be improved and that the manual will be revised by excluding from it the correlations that were collected in the early development phases and by including data from the more substantial standardization and those so tantalizingly suggested in the expectancy chart.
APPENDIX D

TEST BOOKLET
TEST BOOKLET
BROWN-CARLSEN LISTENING COMPREHENSION TEST
LECTURE COMPREHENSION

PLEASE READ BEFORE YOU BEGIN:

Please locate and cut on your headset.

Place your cassette, with the tape group number up, in the machine and close the cover.

Press the green button to listen to the message. Press the black button to stop the tape when final instructions are completed.

Please DO NOT press any other buttons or move any controls.

Do not remove or rewind the cassette.

Please leave your materials in the booth when you are finished.

YOU MAY BEGIN YOUR TAPE RECORDING

Name __________________________________________
Male _______ Female _______
Major _______________________________________
Freshman _______ Sophomore _______
Junior _______ Senior _______
Graduate _____________________________________

STOP

Wait for further instructions before opening this booklet
Lecture Comprehension

SAMPLE

a. Improvement of Reading b. Your Reading
   c. Improving Your Reading Ability d. Methods
   e. You and Your Reading

1. a. mother b. father c. half brother
d. step-mother e. sister

2. f. 6 g. 7 h. 8 i. 10 j. 12

3. a. Whitman b. Eastman c. Lincoln
d. Shakespeare e. Untermeyer

4. f. gloves g. books h. shoes i. silverware
   j. dresses

5. a. baseball b. music c. art
d. gardening e. taxes

6. f. South Dakota g. Wisconsin h. Iowa
   i. North Dakota j. Minnesota

7. a. barbershop b. restaurant c. bus
   d. station e. library f. doctor's office

8. f. on the lawn g. at the dinner table
   h. at the beach i. in the park j. on
   the floor

9. a. date b. headline c. caption
d. outline e. lead

10. f. sentences g. phrases h. letters
    i. words j. lines

11. a. newspaper clipping b. billboards
    c. forcing d. eye regressions
    e. machine

12. f. obtain information g. become interesting
    h. increase enjoyment i. gain inspiration
    j. gain power to learn
13. a. obtain information  b. become interesting  
c. increase enjoyment  d. gain inspiration  
e. gain power to learn  

14. f. An Interesting Guest  g. Writing Newspaper Stories  h. The Three R's  i. Getting the Main Idea  j. Memory Work  

15. a. It is the best method  b. Americans are machine-minded  
c. It has faults as a method  d. It increases comprehension  e. It works with serious cases  

16. f. They give knowledge  g. They miss the real truth  h. They become disturbed by applause  i. They are brilliant  j. They talk too long  

17. a. Everyone can improve  b. Reading is easy  
c. You should force yourself to read an hour a day  d. You shouldn't be ashamed if you don't read well  e. Everyone makes mistakes  

18. f. The machine method  g. The one you like the best  h. The billboard method  i. Not one, but all of them  j. Depends upon how you read  

19. a. understanding  b. power  c. polish  
d. inspiration  e. wealth  

20. f. old-maidish  g. honest  h. clever  
i. home-loving  j. modest  

21. a. Lincoln story  b. Miss Gavigan episode  
c. John Patterson story  d. Billboard incident  e. Discussion of machines