A CORRELATIONAL STUDY OF LISTENING RATE PREFERENCE AND ORAL READING RATES OF SECOND LANGUAGE SPEAKERS

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ABSTRACT

A paired-comparison paradigm was employed to determine the listening rate preferences of second-language users of English. Recordings of a standard prose reading passage were time-altered by means of a commercial speech compression-expansion device to yield nine rates: 100, 125, 150, 175, 200, 225, 250, 275, 300 wpm. A master tape was constructed from these time altered passages and presented to 20 adult male college students who had learned English as a second language for listening rate preference judgments. In addition, the subjects' oral reading rates of the same passages were determined. Results indicate that the subjects' most preferred listening rate was 200 wpm, while the least preferred rates were 100 and 300 wpm. A mean oral reading rate of 108 wpm resulted in a low correlation with the preferred listening rate (200 wpm) of the group. Discussion of the present results and data from past studies of rate preference of English for other second language user groups centers upon knowledge of the phonological structure of the talkers' native language.

The development of specialized equipment to allow for the control of the rate of presentation of recorded speech without serious frequency alteration has fostered numerous studies of listener rate preference (Hutton, 1954; Foulke and Sticht, 1966; Lass and Prater, 1973; Cain and Lass, 1974).

In an early study (Hutton, 1954) of listening rate preference 50 subjects were asked to listen to 40 versions of a standard reading passage which ranged in rate from 77.5 to 412.5 words per minute. The samples were rated on a nine point scale with upper and lower limits called "superior" and "inferior" respectively. Hutton reported that his subjects preferred a speaking rate equal to 163 words per minute.

In a more recent study (Foulke and Sticht, 1966) asked 100 college students to judge the rate of listening material of "moderate" difficulty. Using a method-of-limits scaling procedure, the experimenters found that by allowing the student to electronically manipulate the rate of speech produced, a preferred mean listening rate of 207 words per minute was obtained.

Employing a different psychophysical method of rate preference (paired-comparison), Cain and Lass indicated that when college students listened to a standard prose passage "The Rainbow Passage" (Fairbanks, 1960) they most preferred rates of presentation of 175 words per minute and least preferred rates of 100 and 300 words per minute (Cain and Lass, 1974).

In a similar investigation (Lass and Prater, 1973), the authors determined that college age listeners' rate preferences for oral reading and impromptu speaking were about 175 words per minute. The least preferred rate for each task (oral reading-impromptu speaking) was 100 words per minute.

In a correlational study of listening rate preference and listeners' oral reading rates, the experimenters (Lass and Cain, 1972) had 30 adult subjects read a standard prose passage. Subsequently these same subjects provided listening rate preference judgments for the same passage using a paired-comparison procedure. The experimenters reported a significant positive relationship between their subjects' most preferred listening rate and their oral reading rates. This information suggests a high correlation between reading rate capabilities

of American English talkers and their preferred listening rates for the presentation of verbal materials.

The extent to which North American educational institutions can provide adequate verbal instruction for both North American English talkers who use English as a first or native language and foreign students who use English as a second language is of special interest in view of today's fluctuating global political situation and the influx of immigrants to English speaking North America.

Only a few studies of time compressed speech or rate alteration (Meyerson, 1971; Osser and Peng, 1964) have dealt with the comprehension of manipulated speech parameters by second language speakers whose native language differed significantly from English in structure (ex., Japanese, Chinese, Hindi). One investigator (Meyerson, 1971) reported that although prosodic patterns in English were judged by second language users to be somewhat distorted at 60 percent time compression of the original speech rate, the factor most responsible for a decrease in comprehension seemed to be the rapidity of the input signal and the resultant inability of the listeners to process technically loaded information at this rate of compression. The verbal materials used in the research were usually texts related to Anglo-European history and culture.

It has also been suggested that time compression affects the intelligibility and comprehension of all languages differently. That is, language groups having unique patterns of sounds, grammar, and intonational structure that differ significantly from English may report difficulty in comprehending educational materials produced using compressed English spoken by native American English talkers.

Since many second language users are enrolled in North American higher education institutions, the need to provide the best and most comprehensible verbal materials is imperative. Further, since one of the common criticisms by second language users is the rapid rate of speech used by native English speaking instructors, the purpose of this study was to examine the listening rate preferences of adult listener-speakers who use English as a second language. A second purpose of this investigation was to correlate second language speakers' listening rate preference with their oral reading rate.

METHOD

Subjects

Twenty adult college age males served as subjects. These individuals were selected from the **English Language Institute** at a large southwestern university as current members of that Institute. The subjects were originally from Venezuela and their native language (a dialect of Spanish) had been used in their primary educational instruction. The subjects ranged in age from 18 to 29 years, with a mean age of 23.3 years. Audiological screening at 20 dB (re: 1969 ANSI standards) for octave frequencies 250-8000 Hz indicated normal hearing sensitivity bilaterally for pure tones. None of the subjects reported orofacial or neurological problems that interfered with their production of speech.

Recording Materials

The reading passage employed in this experiment was the first paragraph of a standard prose passage "The Rainbow Passage" (Fairbanks, 1960). The passage was read by a professional male radio announcer and recorded in a sound treated room using a Magnecord, model 1022 tape recorder and associated RCA, model 77DX microphone.

The middle four sentences of the prose passage (55 words) were used for the time alteration procedures. The first and last sentences were deleted in an attempt to avoid biasing effects of start-up and slow-down that might affect listeners' perceptions of the overall reading rate.

This passage was subjected to various speech compression rates in order to develop the master tape for this experiment. The method used to alter this passage (Lexicon, Varispeech I) employs a systematic deletion or repetition procedure to lengthen or shorten the original recording time. Essentially, Varispeech I is an electronically sophisticated random access memory (RAM) device that eliminates the mechanical problems of the older periodic discard apparatus designed by Fairbanks and others (1954) by disposing of high speed rotating heads and sliprings and by incorporating IC materials, digital computer memory, A to D and D to A converters and electronic filtering into the procedure. This procedure allows time compression and time expansion of tape recorded materials without serious distortion to pitch and quality of the recording.

The original recording was time altered to yield nine different rates: 100, 125, 150, 175, 200, 225, 250, 275, and 300 words per minute. A standard rate of speaking was selected as 200 words per minute and was comparable to 196 words per minute rate normally produced by the professional announcer.

Construction of the Master Tape.

A paired comparison procedure described by Guilford (1954) was employed for presentation of the nine different rates for preference evaluation. The master tape included 36 pairs [n (n-1)/2] of the passage with order of presentation as well as order of the individual readings in each pair established to avoid time and space errors (Ross, 1934). Each of the nine rates appeared eight times on the master tape.

In the preparation of the master tape, two high quality Sony, model TC 650 tape recorders were employed to reproduce and redub the nine rates of time alteration for the compression method. In constructing the master tape for listener judgments a one second pause was inserted between each sample pair of readings. In addition, a set of prerecorded instructions and three practice trials for judgments of rate preference were included in the presentation for familiarity purposes.

Listening Session

Each of the 20 subjects participated in a listening session lasting 30 minutes. Subjects' preferences were recorded on a separate sheet of paper by circling one of two numbered pairs. The tapes were presented binaurally to each subject through matching high quality earphones, Superex, model ST-M, from a Sony, model TC 650 tape recorder.

Recording Session

Each subject read aloud in English the first paragraph of Fairbanks' (1960) "The Rainbow Passage" three times in succession. The subject read the passage in his normal speaking manner into a Sony, model F-25 microphone connected to a Sony, model TC-106A tape recorder. For rate of speech data only the middle four of the six sentences in the passage (55 words) were timed with a high quality stop watch. The first and last sentences were deleted in an attempt to avoid any possible rate variation effects associated with initiating and terminating reading.[1]

RESULTS

The results of the subjects' listening rate preference judgments are presented in Table 1.

Table 1.

Experimental proportions, summed proportions, and increasing rank orderings of nine rates based on the evaluations of the 20 second language subjects.

Rates (wpm)	100	125	300	275	150	250	175	225	200
100	—	1.00	.90	1.00	.95	.95	.95	.95	.95
125	.00	—	.35	.80	.95	1.00	1.00	1.00	1.00
300	.10	.65	—	.80	.85	.95	.95	.90	.90
275	.00	.20	.20	—	.70	.90	.90	.95	.85
150	.050	.050	.15	.30	—	.80	.95	.85	1.00
250	.050	.00	.05	.10	.20	—	.60	.75	.90
175	.05	.00	.05	.10	.05	.40	—	.95	.70
225	.05	.00	.10	.05	.15	.25	.05	—	.55
200	.05	.00	.10	.15	.00	.10	.30	.45	—
ΣP	.35	1.90	1.90	3.30	3.85	5.35	5.70	6.80	6.85
Rank Order	**9**	**7**	**7**	**6**	**5**	**4**	**3**	**2**	**1**

[1]The speaking rate data were averaged over the three trials.

The table contains information on the mean proportion of instances in which a given rate was preferred when paired with another rate for each of the nine different rates employed in the study. To obtain the proportions it was necessary to construct tables for each of the 20 subjects and to divide the frequency of judgments in a given category by the total number of judgments made. For example, in Table 1, the value .95 (column 5, row 2) is to be interpreted as follows: approximately 95% of the 20 subjects listening to the master reading tape preferred the rate of 150 words per minute to the rate of 125 words per minute.

The rank ordering of the nine rates investigated, based on all of the obtained proportions for the listening task, reflects the listening rate preferences of the entire group of subjects. To obtain the rank orders for the nine rates, the proportions presented in the table were summed and the rankings were determined from the summed proportions (Σp). The rank orderings corresponding to the Σp in increasing order of preference are given at the foot of each column in the table. The most preferred rate was 200 followed closely by 225 words per minute, while the least preferred rate was 100 followed closely by 300 words per minute.

Another method to describe the preference of the listeners employing estimates of scale separation of the nine speech rates was employed.

Table 2.

The Z matrix for the P matrix of Table 1 eliminating values greater than .98 and less than .02. Column differences represent successive differences in normal deviate scores from the Z matrix. The absolute sums divided by the number of equations, in each

column provides the mean score for each column. The scale values are the cumulative addition of the mean scores from an arbitrary zero point of $\bar{S}_1$.

Rates (wpm)	100	125	300	275	150	250	175	225	200
100	**.000**	—	1.282	—	1.645	1.645	1.645	1.645	1.645
125	—	**.000**	-.385	.842	1.645	—	—	—	—
300	1.282	.385	**.000**	.842	1.036	1.645	1.645	1.282	1.282
275	—	-.842	-.842	**.000**	.524	1.282	1.282	1.645	1.036
150	-1.645	-1.645	-1.036	-.524	**.000**	.842	1.645	1.036	—
250	-1.645	—	-1.645	-1.282	-.842	**.000**	.253	.674	1.282
175	-1.645	—	-1.645	-1.282	-1.645	-.253	**.000**	1.645	.524
225	-1.645	—	-1.282	-1.645	-1.036	-.674	-1.645	**.000**	.126
200	-1.645	—	-1.282	-1.036	—	-1.282	-.524	-.126	**.000**

COLUMN DIFFERENCES

		2-1	3-2	4-3	5-4	6-5	7-6	8-7	9-8
(1)	Sums	1.667	-.161	3.190	2.731	4.805	1.096	3.500	-.996
(2)	n	2	4	8	7	7	8	8	6
(3)	Means	.834	-.043	.399	.390	.686	.137	.438	-.166

SCALE VALUES

$\bar{S}_1$	$\bar{S}_2$	$\bar{S}_3$	$\bar{S}_4$	$\bar{S}_5$	$\bar{S}_6$	$\bar{S}_7$	$\bar{S}_8$	$\bar{S}_9$
.000	.834	.800	1.199	1.589	2.275	2.412	2.850	2.684

Table 2 shows the Z matrix (normal deviate scores) corresponding to proportions of a dichotomized unit normal distribution. Since proportions greater than .98 or less than .02 tell little about scale separation of distance, the Z matrix in Table 2 has been developed to eliminate proportions at the two extremes (Edwards, 1957). This necessitates analysis with an incomplete matrix (Thurstone, Case V), (Edwards, 1957). Accordingly, an averaging procedure for column totals was completed. In this procedure the general formula Z_{2j}-Z_{1j} = $(\bar{S}_2-\bar{S}_1) - (\bar{S}_1-\bar{S}_j) = \bar{S}_2-\bar{S}_1$ is used to make a matrix of successive differences. The sums of these differences are listed below the original Z matrix in Table 2. From these successive column differences, i.e., 2-1, 3-2 the number of equations making up these sums is divided into the column totals; these values make up the mean column difference score.

Scale values, that is, distances between each successive word per minute rate chosen by the 20 listeners is given by the general formula $\bar{S}_i - \bar{S}(i-1) = Di(i-1)$, where $\bar{S}$ is a scale score and D is the distance between scale scores.

The scale score with the lowest rating, in our case, $\bar{S}$, is given a value of .000 and scale values representing other distances are derived by cumulative adding of all Di (distance) values. Thus, this method gives the scale separations of adjacent stimuli (wpm values).

The scale values seen in Table 2 suggest a linear progression from $\bar{S}_1$ through $\bar{S}_9$. The slight decrease in value for $\bar{S}_3$ reflects the tie in ranking between $\bar{S}_2$ and $\bar{S}_3$ as seen in Table 1. $\bar{S}_3$ shows a smaller mean distance from zero ($\bar{S}_1$), hence its probable selection as point 8 on the psychological continuum of word per minute rates should be noted. The same effect holds for

$\bar{S}_8$ and $\bar{S}_9$ which were only .05 apart as proportions (Table 1). The average distance between points on the scale is .334. Without the last three preferences of the subjects, most of the other scale values fall along such a psychological continuum. Further testing with a larger group of second language users would be useful in determining the arbitrariness of our end points on the scale of most preferred speech rates.

In order to compare rate preference data from the present study using non-native speakers of English with previously reported rate preferences by native English speakers, (Lass and Cain, 1972) a Spearman Rho rank order correlation coefficient was performed on data from the two studies. A correlation of 0.85 was obtained. This correlation was significantly different from zero ($t=4.22$, $df = 7$) at the .01 level of confidence (Guilford, 1954). The first four choices for the present listeners and those in the Lass and Cain (1972) study, differed consistently by 25 wpm. That is, the listeners in the present study consistently chose the next fastest rate as compared to Lass and Cain's students, i.e. (200 wpm-present; 175 wpm Lass and Cain). Since Lass and Cain's subjects only placed ratings in four categories, further statistical analysis was not deemed appropriate.

Figure 1 illustrates the relationship between the most preferred listening rate of each subject and his reading rate.

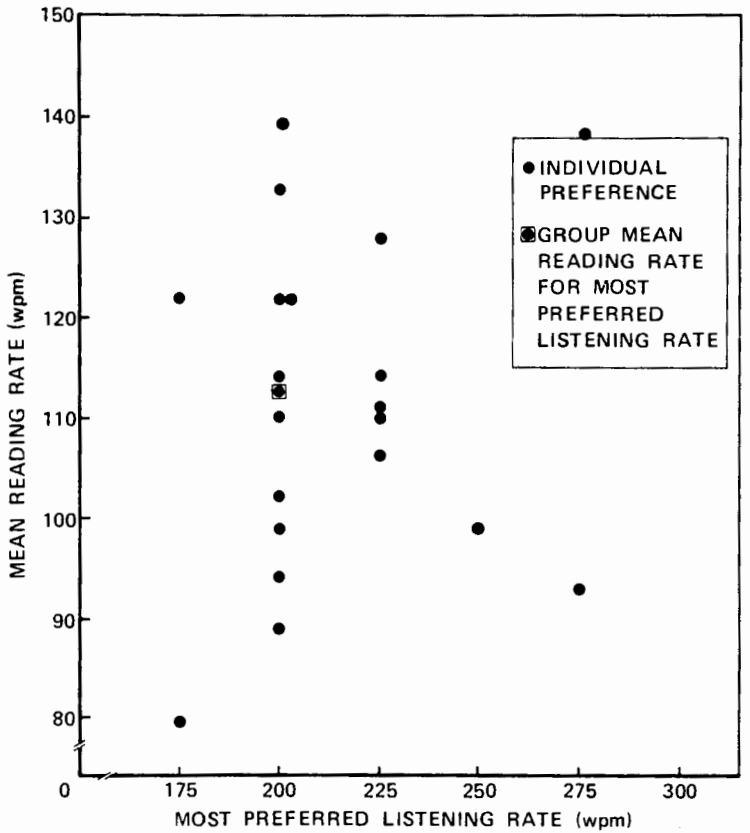

Figure 1. Scattergram showing the relationship of each subject's most preferred listening rate and his oral reading rate (N=20).

The subjects' reading rates did not closely approximate their most preferred listening rates. Oral reading rates ranged from 79 to 139 words per minute with a mean of 107.5 and a standard deviation of 16.55 words per minute. Individual preferred listening rates ranged from 175 to 250 words per minute with a mean of 213.8 words per minute.

To determine differences between tasks, the t statistic was employed. The obtained value ($t = 13.80$, $df = 38$) was significant beyond the .001 level. The Pearson Product-Moment ratio was employed to test for literarity of reading and most preferred listening rate. The correlation ratio was .10; a result not unexpected by the investigators (Guilford, 1954).

DISCUSSION

The results of the present investigation indicate that the subjects most preferred to listen to rates of 200 words per minute and least preferred to listen to rates of 300 and 100 words per minute. It is interesting to note that these findings are in moderate agreement with the majority of research available on listening rate preferences for native American English speakers. Hutton (1954) reported that his English speaking subjects preferred a speaking rate equal to 163 words per minute. Cain and Lass (1974) and Lass and Prater (1973) found that their college age subjects preferred to listen to rates of 175 words per minute. The findings of the present study are closer in agreement with those of Foulke and Sticht (1966), and Lass and Leeper (1977). The most preferred listening rate chosen by Foulke and Sticht's subjects was 207 words per minute and Lass and Leeper's college age subjects preferred a rate of 200 words per minute.

The listening rate preferred by second language speakers of English may in part be explained by the results of a study by Osser and Peng (1964) who described their attempt to investigate the cultural stereotype judgments of speech rate. They suggest that the reports of people listening to a language that is not their native language is that the speaker always appears to be talking very rapidly. They proposed the following hypotheses relating to the way in which the rate of speech is judged.
1) When native English speakers listen to English they attend to the way in which the speaker distributes his speech and pauses over time. 2) When listening to a foreign language being spoken the listener does not hear the short pauses, only the very long ones. The listeners seem to hear the continuous flow of speech. Translating this into their experiences of hearing the flow of fast English speech they judge this "foreign" speech to be very fast. 3) As the acquaintance with a foreign language develops, the listener learns more and more about the units in the flow of speech and is more likely to judge the rate of the speech more accurately.

An alternative interpretation may also be appropriate. It is based on the syllabic structure of speech and is also related to the judgment of the rate of speech of the foreign language spoken. This interpretation suggests that the listener judges the speech rate of a foreign language talker in terms of his phonological background. For example, when the Japanese speaker hears a bundle of dense consonant clusters of English he hears them in terms of the syllabic structure of Japanese. Since Japanese does not have as many consonant clusters as does English, the listener judges the speech to be faster than it is in actuality. Similarly, when the English speaker hears the successive vowel phonemes in Japanese, he hears and/or references the language in terms of the syllabic structure of his own language which does not have as many vowel clusters or the high frequency of vowel phonemes. Thus the listener judges the speech to be faster than his native language.

It should also be noted that all of the passages heard by listeners in the present study were time altered in a deleterious manner. That is, normal pauses and prosodic factors were maintained in the 200 word per minute segment but were compressed or expanded to various degrees to obtain the fast and slow rates of speech desired for the rate preference study. This fact alone may have altered the judgments of rate by some second language speakers by disturbing their

reference for English typically spoken to them in their home country by a native Venezuelan who was their first teacher of English. This could cause the larger range of individual rate preferences across subjects found in the present study.

On the average, each subject's reading rate was approximately 100 words per minute slower than their most preferred listening rate. However, subjects with slower than average reading rates did not frequently prefer slower than average listening rates and those with faster reading rates did not typically prefer faster than average listening rates. The correlation coefficient of .10 does not correspond with that of Lass and Cain (1972). These investigators found a correlation coefficient of .61 when testing the relationship between oral reading rate and most preferred listening rate of native speakers of English. The reading rates of Lass and Cain's study were also higher than the reading rates found in the present study. This finding is to be expected of second language speakers who are still learning the language. Listening to an English passage is relatively simple when compared to reading an English passage because listening involves only the decoding process. Reading, on the other hand, involves the processes of decoding of written symbols, sequencing the graphemes in the correct order, and scanning the passage while integrating this material into the correct expressive sentences. Further, speech motor patterns consistent with the production of new sounds in a non-native language must also be considered as an important variable.

It should also be remembered that the present study was concerned only with oral reading rates and not with rates for other types of speaking. The same is true for the listening rate preference stimuli, which involved samples of oral reading and not impromptu speeches. Since it has been demonstrated that there are some basic differences in overall rate and pause time for oral reading and impromptu speaking tasks, generalizations from information obtained with oral reading rate preferences should be conservatively regarded. In fact, the present writers suggest that if the speaking rate for impromptu speech had been calculated a higher correlation coefficient would have resulted.

It should be noted that the present study did not require listener comprehension of the material and required little attention to the actual linguistic context of the passage. A previous study (Meyerson, 1971) indicated that as compression levels increased comprehension scores of subjects on tests in English, Hindi, Japanese and Chinese all decreased. In addition, George (1974) reported a decrease in comprehension with increasing rate of presentation for native English speaking subjects in his experiment. An investigation completed by Orr, Friedman, and Williams (1974) suggested that under conditions where 80% or more of normal speech comprehension is acceptable, even naive native English speaking listeners can tolerate close to twice normal presentation speeds. These investigators also indicated that with 8 to 10 hours of training substantially higher compression rates were tolerated and acceptable to native English speaking listeners. It is suggested that if the present listening task had involved a degree of comprehension of spoken material the most preferred listening rates would have been substantially lower.

At a time when the higher education curriculum is becoming crowded with required courses, the possibility of presenting a given amount of information in substantially less time is certainly of potential learning significance. Time freed in such a fashion might be used for increasing the number of students taught by an individual instructor, for increasing the amount of material presented or for engaging in any one of a number of activities such as discussion, review, self-study, demonstrations, or other innovative activities. Further research is needed to determine the rate preferences of other language groups and to so consider the effect of time compressed/expanded speech on the comprehension capabilities of second language speakers in the North American educational environment.

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