THE IDENTIFICATION OF SPEAKER CHARACTERISTICS ON THE BASIS OF AURAL CUES

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
G. PATRICK NERBONNE
1967

ABSTRACT

THE IDENTIFICATION OF SPEAKER CHARACTERISTICS ON THE BASIS OF AURAL CUES

by G. Patrick Nerbonne

The major purpose of this investigation was to evaluate the performance of listeners in identifying correctly the speaker characteristics of Sex, Age, Ethnic Group, Education Level, Physical Size, and Dialect Region of the Country on the basis of aural cues alone. Of additional interest were the effects of listener training, normal as opposed to telephone speech, spontaneous as opposed to prepared speech, and speech sample duration on the performance of listeners.

Six groups of 23 persons each served as listener subjects. Three of the groups were exposed to training procedures while the remaining three groups served as untrained listener subjects. One trained and one untrained group made identifications of the speaker characteristics on the basis of listening to speech samples under each of three duration conditions; five seconds, ten seconds, and 15 seconds.

Speech samples were provided by selected speakers. Six speakers provided the stimuli for identifying the Sex

characteristic, three males and three females. The same number of speakers provided the stimuli for the Ethnic Group and Physical Size characteristics. These were, respectively, three Negro and three Caucasian speakers and three big (equal to or larger than six feet in height and 180 pounds in weight) and three small (equal to or smaller than five feet, six inches in height and 121 pounds in weight) speakers. Nine speakers provided the stimuli for identifying the Age characteristic, three between the ages of 20 and 30 years, three between the ages of 40 and 50 years, and three between the ages of 60 and 70 years. The same number of speakers provided the stimuli for the Education and Dialect Region characteristics. For the former, these were three speakers with less than a high school education, three speakers who had graduated from high school, and three speakers who were college graduates. For Dialect Region, three speakers were from the East, three were from the South, and three were natives of Michigan. All speakers were males with the exception of the females employed for the Sex characteristic.

Each listener subject made eight identifications of the Sex, Ethnic Group, and Physical Size characteristics, two under each of the following speech treatment combinations: (1) spontaneous normal speech; (2) spontaneous telephone speech; (3) prepared normal speech; and (4) prepared telephone speech. For the Age, Education, and Dialect Region

characteristics, each listener subject made 12 identifications, three under each of the above speech treatment combinations.

Speech samples were presented to the listener subjects by means of magnetic tape. Re-test measures were made 48 hours after administration of the actual test for each group. Listener subject performance was measured in proportion correct.

Results indicated the following conclusions: (1) Listeners can differentiate accurately between (a) male and female speakers, (b) Negro and Caucasian speakers, and (c) big and small speakers, and among (d) 20 to 30 year old, 40 to 50 year old, and 60 to 70 year old speakers, (e) speakers with less than a high school education, high school graduates, and college graduates,, and (f) speakers from the Eastern, Southern, and General American dialect regions. (2) Groups of listeners seem to be highly consistent in their identifications of the speaker characteristics on separate occasions. However, the same conclusion cannot be drawn with regard to single listeners. (3) Short term training, as it was employed in the present investigation, does not significantly improve the performance of listeners in making correct identifications of the speaker characteristics. (4) Differentiations among age categories of speakers can be made more effectively on the basis of spontaneous aural cues

(extemporaneous speech) than on the basis of prepared aural cues (oral reading). (5) Differentiations between Negro and Caucasian speakers and between big and small speakers can be made more effectively on the basis of prepared aural cues (oral reading) than on the basis of spontaneous oral cues (extemporaneous speech). (6) Differentiations among the age categories of speakers and among speakers from the three dialect regions of the country can be made more effectively on the basis of aural cues provided by telephone speech than by the aural cues provided under conditions that simulate face-to-face conversation. (7) Differentiations between big and small speakers can be made more effectively on the basis of the aural cues provided by conditions that simulate face-to-face conversation than by aural cues provided by telephone speech. (8) Aural cues of ten seconds duration are a more effective means by which to make differentiating judgments relative to the speaker characteristics than are aural cues of five and 15 seconds duration.

THE IDENTIFICATION OF SPEAKER CHARACTERISTICS ON THE BASIS OF AURAL CUES

By

G. Patrick Nerbonne

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Speech

1967

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

The communication that takes place by means of the oral interchange of symbols is not determined solely by the particular units uttered. The manner in which the units are spoken, i.e., tone of voice, rate of speech, vocal pitch, and similar verbal dimensions, can also take on value and contribute significantly to the listener's interpretation of the verbal message. In addition, it was also believed that such dimensions can provide the listener with information about the speaker. This aspect, of verbal behavior, was the concern of the present study.

Purpose of the Study

It was the purpose of this study to determine the extent to which various characteristics of speakers can be accurately and reliably identified by listeners through exposure to aural cues alone. Specifically, the speaker characteristics in question were: (1) Sex; (2) Age; (3) Ethnic Group; (4) Education Level; (5) Physical Size; and (6) Dialect Region of the country. Of additional interest in terms of identifying these characteristics were the effects

of (1) listener training; (2) differing conditions of aural cue duration; (3) spontaneous (extemporaneous) as opposed to prepared (oral reading) speaking conditions; and (4) simulated face-to-face speech as opposed to the distorted speech signal listeners hear over the telephone. In considering these problems, the following questions were posed at the outset:

1. Can listeners identify correctly each of the speaker characteristics in question on the basis of aural cues alone and, if so, are these identifications reliable as well as correct?

2. Does training make a difference in the performance of listeners in the correct identification of each of the speaker characteristics in question on the basis of aural cues alone?

3. Does presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech make a difference in the performance of listeners in the correct identification of each of the speaker characteristics in question on the basis of aural cues alone?

4. Does spontaneous presentation of the message as opposed to prepared presentation of the message make a difference in the performance of listeners in the correct identification of each of the speaker characteristics in question on the basis of aural cues alone?

5. Is there an interaction effect between training and presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech on the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone?

6. Is there an interaction effect between training and spontaneous presentation of the message as opposed to prepared presentation of the message on the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone?

7. Is there an interaction effect between presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech and spontaneous presentation of the message as opposed to prepared presentation of the message on the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone?

8. Are there interaction effects among training, presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech, and spontaneous presentation of the message as opposed to prepared presentation of the message on the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone?

9. Does duration of the speech sample make a difference in the performance of listeners in the correct identification of the speaker characteristics in question on the basis of aural cues alone?

10. Is there an interaction effect between training and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone?

11. Is there an interaction effect between presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone?

12. Is there an interaction effect between spontaneous presentation of the message as opposed to preapred presentation of the message and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone?

13. Are there interaction effects among training, presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech, and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone?

14. Are there interaction effects among training, spontaneous presentation of the message as opposed to prepared presentation of the message, and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone?

15. Are there interaction effects among presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech, spontaneous presentation of the message as opposed to prepared presentation of the message, and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone?

16. Are there interaction effects among training, presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech, spontaneous presentation of the message as opposed to prepared presentation of the message, and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone?

Importance of the Study

In terms of the content-free aspects of verbal behavior providing the listener with information about the speaker, Barbara has indicated that his interest in speech communication has been based on his belief that speech and personality are one.[1] It was his contention that the symbolization process is a fundamental aspect of the whole personality. Barbara felt that man creates symbols not only to communicate verbally with others and thus establish

---

[1]Dominick A. Barbara, Your Speech Reveals Your Personality (Springfield, Ill.: Charles C. Thomas, 1958), p. xi.

interpersonal relationships, but also as an integrating process within himself. He further stated that in man's attempts to find himself in his search for inner truth and psychic unity, he, of necessity, creates a personal language of his own, with verbal and non-verbal symbols peculiar and specific to his own way of life.[2] Following this same train of thought, Murray related verbal behavior and the individual characteristics of the speaker by referring to a speech personality which he described as developing slowly according to ". . . laws of a differentiating, expanding, and unitary behavior pattern . . ." just as personality itself does. This behavior, Murray felt, is composed of thought, language, voice, and action.[3] He indicated that speech development in the child parallels personality development and the same conditions that constrict, distort, or enhance the one, constrict, distort, or enhance the other.[4] As the child grows, speech and personality grow, develop, differentiate, and become refined together. Speech is a phase of personality and as such, speech and personality are one and the same thing. Based upon this contention, Murray completed the cycle by

---

[2] Ibid., p. 20.

[3] Elwood Murray, "A Study of Factors Contributing to the Mal-Developing of the Speech Personality," Speech Monograms, III (September, 1936), pp. 95-108.

[4] Elwood Murray, The Speech Personality (Chicago: J. B. Lippincott Co., 1944), p. vii.

indicating that genuine speech improvement depends upon personality development.[5]

The question of whether or not the communication that takes place by means of conventional verbal expression is limited to content alone, i.e., the meanings individuals attach to symbols and their combinations, is of evident importance. Many professional persons interested in this area feel that such verbal dimensions as the tone of voice, rate of speech, grammatical usage, fluency, and other such characteristics carry communicative value about the speaker and the message carried by his words that is not obvious or available by the words alone. Barbara, for example, stated that in our culture, people judge one's character, intellectual capacity, and social standing by the way he talks.[6] In addition, Fairbanks and Pronovost found that male speakers, when asked to simulate the emotions "contempt," "anger," "fear," "grief," and "indifference" in the reading of five different paragraphs, actually used different pitch levels on each selection.[7] The fact that these pitch differences were found is evidence in support of the contention that communication does not take place by word meaning alone.

---

[5] Ibid., p. 8.

[6] Barbara, op. cit., p. 3.

[7] Grant Fairbanks and Wilbert Pronovost, "An Experimental Study of the Pitch Characteristics of the Voice During the Expression of Emotion," Speech Monographs, VI (December, 1939), pp. 87-104.

Furthermore, when the authors presented recordings to listeners made during the oral reading of a sentence common to each of the five emotion paragraphs, they found remarkable interjudge agreement. The recordings simulating "indifference" and "contempt" were judged by 88 and 84 per cent of the listeners, respectively, to be conveying these emotions. Interjudge agreement on the emotions "anger" and "grief" was 78 per cent while 66 per cent of the listeners evaluated the simulations of "fear" as really conveying this emotion. Licklider and Miller indicated the importance of both of the items cited above.[8] They stated that speech serves not only as a carrier for the intelligence of materials and meaning, as shown by Fairbanks and Pronovost,[9] but it also furnishes secondary information about the speaker, e.g., his identity, background, and so forth, as suggested by Barbara.[10] With reference to this latter point, Murray indicated that speech development is the result of the entire history of a person. One's heredity and total environment make him what he is; and his speech growth, just as the other factors that make him an individual, parallels his unfolding physical, intellectual, emotional, and moral

---

[8]J. C. R. Licklider and George A. Miller, "The Perception of Speech," Handbook of Experimental Psychology, ed. S. S. Stevens (New York: John Wiley and Sons, 1951), pp. 1040-1074.

[9]Fairbanks and Pronovost, loc. cit.

[10]Barbara, loc. cit.

powers.[11] Barbara wrote that each newborn child has his own moods, temperaments, potentialities, gifts, and particular capacities. Also, each individual child has his own physical, mental, and emotional attributes.[12] Speech is learned without conscious effort and as we begin to relate interdynamically with the world about us, it assumes a special character and identity of its own. Depending on our own individual life-experiences, needs, education, beliefs, attitudes, feelings, and convictions, as well as the individualities with which we are born, our modes of speaking assume their own form, shape, and purpose.[13]

The individuality of verbal expression was also described by Lojos.[14]

> Voice tells its own story. There are a million different kinds of voices . . . Some voices are formed by robust muscles; they boom like trumpets, carry their messages with graceful ease. You do not see voices, but you know them as well as if you had seen them.

According to Barbara, the verbal use of symbols is also an individual thing. He felt that the symbols one chooses to use from the whole body of those available depends

---

[11]Murray, The Speech Personality, p. 9.

[12]Barbara, op. cit., p. 37.

[13]Ibid., p. 6.

[14]Egri Lojos, Your Key to Successful Writing (New York: Henry Holt Co., 1952), p. 57.

on his physical structure, environment, and psychic health, in addition to conventionality.[15]

As indicated above, the present study was not concerned with what the content-free aspects of verbal behavior communicate to listeners with regard to what the speaker is saying, but what these verbal dimensions communicate to listeners about the speaker himself. The importance of such information is evident from several standpoints. Positive results would be applicable for law enforcement and/or security purposes and would be consistent with current thinking with regard to voice printing. More practically, however, the project was of interest from the standpoint of both input and output. In terms of the latter, the project involved spontaneous and prepared speech samples, each delivered to the listeners under undistorted (normal) and telephone speech conditions. In addition, the speech samples in question were of extremely short duration (from five to 15 seconds). In terms of input, three aspects were of interest: (1) the fact that only the auditory input channel was available to the listeners as they attempted to make the discriminations requested of them; (2) the possibility of obtaining differences in listener performance that could be attributed to the various output conditions described above; and (3) the possible effects of training. The fact that only one input

[15]Barbara, op. cit., p. 20.

channel (auditory) was utilized may also have certain implications for the blind.

In addition to these considerations, of primary concern to the experimenter on the question of significance or importance was the possible contribution of the study toward a more complete understanding of normal speech.

Definitions

Listeners.--Undergraduate college students at Michigan State University who were enrolled in Speech 108, Voice and Articulation, Spring quarter, 1967, served as listeners. These listeners are referred to in the report as listener subjects.

Listener training.--Listener subjects were trained by a combination of lecture and tape recorded practice samples designed to acquaint them with various cues to listen for in identifying each of the speaker characteristics. One training session took place with each group of trained listener subjects. These sessions were conducted in their usual classroom and occurred immediately before the actual test situation. A 15 item practice test was administered at the end of the training program.

Speaker characteristics.--The listener subjects were asked to identify six characteristics of speakers. These characteristics and their various dimensions were:

1. Sex
    a. Male
    b. Female

2. Age
    a. 20 - 30 years
    b. 40 - 50 years
    c. 60 - 70 years

3. Ethnic Group
    a. Negro
    b. Caucasian

4. Education Level
    a. Less than a high school graduate
    b. High school graduate
    c. College graduate

5. Physical Size
    a. Big
    b. Small

    These two terms were defined relative to standard norms for 17 to 19 year old males. "Big" speakers were equal to or larger than six feet in height and 180 pounds in wieght. "Small" speakers were equal to or smaller than five feet, six inches, in height and 121 pounds in weight.

6. Dialect Region
    a. Michigan (represented by speakers from Michigan)
    b. South (represented by speakers from Georgia and South Carolina)
    c. East (represented by speakers from eastern Massachusetts)

Aural cues.--The stimuli by which listener subjects made their identifications were tape recorded samples of speech delivered to them by means of a loudspeaker. These cues varied in three ways: (1) spontaneous speech versus prepared speech; (2) normal speech versus telephone speech; and (3) duration.

Spontaneous aural cues.--These stimuli consisted of tape recorded samples of extemporaneous oral descriptions of the content of a written "neutral" paragraph.

Prepared aural cues.--These stimuli consisted of tape recorded samples of oral readings of a written "neutral" paragraph.

Normal aural cues.--These stimuli consisted of samples of speech (both spontaneous and prepared) recorded on magnetic tape by means of a microphone and tape recorder in the usual manner and played back to the listener subjects unchanged in any way.

Telephone aural cues.--These stimuli consisted of samples of speech (both spontaneous and prepared) recorded on magnetic tape from a telephone receiver as the speakers talked into a second telephone during a typical station to station call.

Duration of aural cues.--The length of the speech samples varied across all spontaneous-prepared and normal-telephone conditions. Aural cue durations were: (1) five seconds; (2) ten seconds; and (3) 15 seconds.

Limitations of the Study

Several limitations were built into the study, most of which occurred because of facilitative purposes. That is, they were introduced in order to make the study feasible.

The first of these limitations involved the speaker characteristics studied. Quite obviously, the six characteristics selected for the present study did not exhaust all possibilities with regard to differentiating between speakers on the basis of aural cues. These six, however, were of interest to the experimenter and did possess the additional qualification of being measurable in the environment in which the study was conducted.

Another limitation of the study had implications in terms of the applicability of the results. This involved the manner by which the listener subjects received their aural cues. As indicated above, these cues were supplied by magnetic tape as opposed to live voice. This limitation, however, is of minimal concern due to the quality of instrumentation used.

Perhaps the most important limitation of the study involved the relationships among the speaker characteristics as different speakers were employed for each characteristic. Ideally, the same set of speakers would have been employed with these speakers being matched appropriately over all six characteristics, i.e., sex, age, ethnic group, education level, physical size, and dialect region of the country. Had this been accomplished, the interrelationships of the speaker characteristics could have been studied, e.g., identifying a speaker's age given a specific combination of sex, ethnic group, physical size, etc. This limitation was introduced

into the study in the interest of obtaining a wide range of information. That is, the experimenter sacrificed a relatively complete investigation of a few speaker characteristics in order to obtain some knowledge about several characteristics. This decision was based on two factors: (1) the relative absence of previous studies with regard to listener identification of the speaker characteristics in question and (2) because so little is known about listener identification of speaker characteristics, it was felt that, at this point, some general knowledge was necessary before study of the interrelationships between these factors could be realistically attempted. That is, it appeared unreasonable to the author to seek specific knowledge about how the presence or absence of varying degrees of one or several characteristics of a speaker affects the performance of listeners in identifying another characteristic of his speech if it is not known whether or not such an identification can be made in a general or gross manner. Furthermore, the important breadth of the present study would have been unfeasible if the depth referred to above had become a question of immediate concern.

Organization of the Report

Chapter I has introduced and stated the problem including the hypotheses, the importance of the study, and the definition of terms.

Chapter II consists of a comprehensive review of the previous literature with regard to listeners identifying characteristics of speakers, the significant aural cues to be considered under each speaker characteristic in question, listener training, and considerations in terms of the various speech and duration conditions.

Chapter III is concerned with the description and selection of the listener subjects, equipment used in recording the speech samples, editing and preparing the master tapes, and presentation of the master tapes to the listener subjects and the procedures employed.

Chapter IV presents the results and discussion, and Chapter V consists of the summary and conclusions.

CHAPTER II

REVIEW OF THE LITERATURE

Kramer reported that in a fantasy novel by Robert Graves, a man of the distant future asks a twentieth century Englishman, "Do I speak with correctitude?" "With great correctitude," he is assured, "But without the modulations of tone we English use to express, or disguise, our feelings."[16] Kramer used this illustration to show that all of us not only use such modulations ourselves, but also make judgments about others' current feelings and attitudes as well as about more stable personal characteristics such as those under study in the present investigation, partly on the basis of how they "sound" to us. Sullivan has stated that these "sound accompaniments suggest what is to be made of the verbal propositions stated."[17] Whether or not we can interpret them correctly, whether or not the speaker and listener would agree as to their significance, these "non-verbal" but nonetheless

---

[16]Ernest Kramer, "Judgment of Personal Characteristics from Nonverbal Properties of Speech," Psychological Bulletin, LX (July, 1963), pp. 408-420.

[17]H. S. Sullivan, The Psychiatric Interview (New York: Norton, 1954), p. 7.

primarily vocal aspects of the exchange," play an important part in the perception of person.[18]

The first major experiment on impressions of persons based on voice alone was performed by Pear.[19] He analyzed over 4,000 reports from British radio listeners who had responded to questions about nine different readers they had heard on the air. Age and sex proved easiest to estimate correctly. An actor and a clergyman were most consistently identified correctly from among the nine professions represented. The highest leadership ratings were given to the speakers whose voices were professionally important to them: an actor, a judge, and a clergyman. Birthplace of the speakers was not guessed with significant accuracy. Certain errors in guessing a speaker's profession showed significant consistency, suggesting that some voices provide a stereotype of a certain occupation even though this is not the actual occupation of the speaker. Such "vocal stereotypes" have remained the most frequent finding in all studies of the relationship between voice and personality.[20]

The studies that followed this first investigation can be placed under two major categories: those which

---

[18] Ibid., p. 5.

[19] T. H. Pear, Voice and Personality (London: Chapman and Hall, 1931), p. 117.

[20] Ernest Kramer, "Personality Stereotypes in Voice: A Reconsideration of the Data," Journal of Social Psychology, LXII (April, 1963), pp. 247-251.

called for listener judgments from voice about relatively stable characteristics of an individual, and those which asked for these judgments about emotional or affective variables which change over relatively short periods of time. For the most part, both kinds of judgments involve the separation of nonverbal aspects of the voice from the actual words spoken as well as problems with regard to adequate independent criteria for the traits being judged. Physical characteristics of an individual may usually be easily measured; but aptitudes, interests, and personality traits have presented special problems. Such paper and pencil inventories as those by Benreuter[21] and Bell[22] frequently used in such studies, have according to McKelvey[23] and Tyler,[24] many limitations of their own. Because of these limitations, Kramer felt that even if valid judgments with regard to aptitudes, interests, etc., were made from the voice by listeners, the correlation between such judgments and scores from the inventories listed above might frequently be low just on

---

[21]R. Bernreuter, Personality Inventory (Stanford: Stanford University Press, 1931).

[22]H. M. Bell, Adjustment Inventory (Stanford: Stanford University Press, 1934).

[23]D. P. McKelvey, "Voice and Personality," Western Speech, XVII (1953), pp. 91-94.

[24]Leona Tyler, "Test Review Number 77," The Fourth Mental Measurements Yearbook, ed. O. Buros (New Jersey: Gryphon Press, 1953), pp. 27-33.

the basis of the shortcomings of these inventories themselves.[25]

All six of the speaker characteristics of interest in the present study can be described as stable characteristics of an individual.

The Speaker Characteristics

Sex

Following Pear's initial success, little or nothing has been done with regard to ascertaining listener performance in judging sex of speakers.[26] Apparently, this characteristic has appeared to be too obvious. Evidence that differentiation between the sex of speakers can be made is supported in a related manner by two studies by Altus.[27,28] He found that readers, i.e., receptors of graphic language, can infer the sex of professional short story writers at a level better than what could be expected by chance on the basis of only a few words at the beginning of each story. This result, in conjunction with the evidence obtained by

---

[25] Kramer, "Personality Stereotypes in Voice: A Reconsideration of the Data."

[26] Pear, loc. cit.

[27] W. D. Altus, "Sexual Role, the Short Story, and the Writer," Journal of Psychology, XLVII (January, 1959), pp. 37-40.

[28] W. D. Altus, "Inferring the Sex of an Author," Journal of Psychology, XLVIII (October, 1959), pp. 215-218.

Pear,[29] would seem to indicate that the language output of males and females, whether graphic or verbal in nature, may be identifiable in terms of the gender of the producers.

In terms of objective studies, i.e., without listeners, the primary differentiating feature between the speech of males and females has been found to be vocal pitch. Snidecor found that median pitch levels for women's voices were approximately two-thirds of an octave above the median pitch levels of men's voices.[30] Fisher, using the term "modal" pitch, which she defined as "the note which is used most frequently," was more specific.[31] She specified the modal pitch of adult males as C_3 on the musical scale and the modal pitch of adult females as G_3. Hanley and Thurman felt that inflection and intonation as well as pitch level conveys information about the speaker and his attitude.[32] They used the term "habitual" pitch and also stated the male norm as C_3. However, these two authors listed the female pitch level as

---

[29]Pear, loc. cit.

[30]John C. Snidecor, "The Pitch and Duration Characteristics of Superior Female Speakers during Oral Reading," Journal of Speech and Hearing Disorders, XVI (February, 1951), pp. 44-52.

[31]Hilda B. Fisher, Improving Voice and Articulation (Boston: Houghton Mifflin Co., 1966), p. 165.

[32]Theodore D. Hanley & Wayne L. Thurman, Developing Vocal Skills (New York: Holt, Rinehart and Winston, 1963), p. 143.

G_3, slightly higher than Fisher.[33] Black and Moore stated[34]

> The male speaker who might be selected to represent all male voices would have an average pitch a little higher than C below middle C, or 128 waves per second. This is approximately an octave lower than the average pitch of the representative female voice, a little lower than 256 waves per second.

Fletcher indicated that the pitch of the voice when speaking the vowels varies with different individuals, corresponding to about 90 cps for a very deep-voiced man and to about 300 cps for a shrill-voiced woman.[35] In agreement with Black and Moore,[36] he felt that the average pitch used by a woman is near middle C or 256 cps while that of a man is about one octave lower. In addition, he charted the mean fundamental frequency used by males and females for "pure vowels." These are listed in Table 1.[37]

Hahn, et al. attributed these differences in vocal frequency to four factors pertaining to the human vocal folds: (1) length--the pitch is lowered as the length increases; (2) thickness--the pitch is raised as the tension increases; (3) tension--the pitch is raised as the tension

---

[33]Fisher, loc. cit.

[34]John W. Black & Wilbur E. Moore, Speech: Code, Meaning, and Communication (New York: McGraw-Hill Book Co., 1955), p. 49.

[35]Harvey Fletcher, Speech and Hearing in Communication (New York: McGraw-Hill Book Co., 1955), p. 49.

[36]Black and Moore, loc. cit.

[37]Fletcher, op. cit., p. 62.

Table 1. Mean fundamental frequency used by males and females for "pure vowels."

Sound	Mean Fundamental Frequency	
	Male	Female
u	140 cps	270 cps
ʊ	138	250
o	116	237
ɔ	112	243
ʌ	118	253
a	113	234
ar	110	231
æ	123	232
ɛ	121	247
ɜ	131	239
e	125	235
I	137	253
i	136	252
Means or "Normals"	125 cps	244 cps

increases; and (4) density--the pitch is lowered as the density increases.[38] They indicated that all four factors are involved in the differences between any two voices and explain the lower pitch of men's voices, as compared with those of women and children, on the basis of longer and thicker vocal folds. Fisher felt that the differences in male and female pitch levels is due to vocal cord length.[39] She stated that male vocal cords average between three-quarters of one inch in length while those of females average

[38] E. Hahn et al., Basic Voice Training for Speech (New York: McGraw Hill Book Co., 1957), p. 57.

[39] Fisher, op. cit., p. 157.

from one-half to three-quarters of an inch in length. Hollien found that low pitched individuals exhibit longer vocal folds than do individuals with higher pitch levels, both between the sexes and within a sex.[40] In a similar study, Hollien and Curtis observed that individuals with low pitch levels exhibit larger, more massive vocal folds than do individuals with higher pitch levels.[41]

Pitch, as an attribute of vowel sounds, has usually been attributed to (and considered the psychological counterpart of) the fundamental frequency in the complex periodic wave structure of speech tones. Harbold, however, suggested that the pitch attribute of speech might not be completely dependent upon the fundamental.[42] He supported this contention by conducting an investigation of the pitch ratings of listeners for voiced and whispered vowels. His results indicated that the listener judgments of the relative pitch of vowels was not independent of the vowel itself. This was illustrated by his obtained high correlation between rank and order of voiced and whispered vowels which is impressive

---

[40]H. Hollien, "Vocal Pitch Variation Related to Change in Vocal Fold Length," Journal of Speech and Hearing Research, III (June, 1960), pp. 150-156.

[41]H. Hollien and James F. Curtis, "A Lamenographic Study of Vocal Pitch," Journal of Speech and Hearing Research, III (December, 1960), pp. 361-371.

[42]George J. Harbold, "Pitch Ratings of Voiced and Whispered Vowels," Journal of the Acoustical Society of America, XXX (July, 1958), pp. 600-601.

in view of the fact that the latter speech-type does not contain the fundamental frequency ordinarily credited as a physical basis for pitch interpretation.

An investigation performed by Meyer-Eppler studied the relationship of vocal pitch and whispering in a different way.[43] He stated that speakers can be understood without difficulty when they whisper and that this is true even in a tonal language such as Chinese where pitch is used to differentiate the meaning of various lexical items consisting of otherwise identical groups of phons. Meyer-Eppler found that these necessary whispered "pitch variations" are accomplished in various ways. For example, in the [e] and [o] sounds, raising the "pitch" is done by increasing whispered intensity, thus filling the gaps in the higher spectral regions with noisy components and eventually broadening the formants above two kc to a less-sharply profiled, fricative-like spectrum. That is, for these vowels, spectral noise alterations are substituted for pitch alterations. Their formants do not change in the process even though the speaker intends "pitch" change and the listener perceives it.

A study by Snidecor related this important differentiating characteristic of vocal pitch to an important factor with regard to speech cues in the present study; that of extemporaneous (spontaneous) as opposed to prepared

---

[43] W. Meyer-Eppler, "Realization of Prosodic Features in Whispered Speech," Journal of the Acoustical Society of America, XXIX (January, 1957), pp. 104-106.

(reading) speech.[44] He found, using male speakers, that readings were slightly higher in mean pitch (132 cps) than were extemporaneous speeches (120 cps). In addition, mean pitch variability was greater when the subjects were reading than when they were speaking as was the mean extent of inflections and up-ward shifts.

Silverstein, et al., in their investigation of the intelligibility of male and female speakers, found another factor which may serve to help listeners differentiate between the speech of males and females.[45] They observed that previous authors had found that, in terms of speech, males and females could not be considered as coming from the same population--the primary differentiating variable having been vocal pitch. Their study, however, indicated that the same differentiation could be made on the basis of intelligibility of untrained male and female speakers in the presence of noise. These authors found that untrained male speakers were significantly more intelligible under these conditions than untrained females. Furthermore, the sex of the listeners seemed to have little or no effect upon the intelligibility of these speakers. Their results also indicated that training removed the obtained differences and that the primary

[44] Snidecor, loc. cit.

[45] B. Silverstein, et al., "The Relative Intelligibility of Male and Female Talkers," Journal of Educational Psychology, XIX (November, 1953), pp. 418-428.

contributing factor in the improvement of the intelligibility of the females after training was increased syllable duration.

This combination of results is consistent with those of Snidecor in terms of the reading rate.[46] This author, in comparing his findings for women readers to Pronovost's with male readers,[47] found that, while the reading rate of males was more rapid, the mean phonation length per unit, i.e., per syllable, word, sentence, or paragraph, was shorter for females. That is, a larger proportion of the reading time for females was spent in empty pauses between phonations while the male readers consumed a larger proportion of the reading time with actual phonation. Using his own results with female readers and Pronovost's[48] with male readers, Snidecor[49] computed the mean ratio of phonated time to total reading time. These figures were 0.63 and 0.75, respectively, for the female and male readers and give numerical support to the discussion immediately above. The conclusion drawn from this portion of Snidecor's study supports the results of Silverstein, et al.[50] with regard to intelligibility

---

[46] Snidecor, loc. cit.

[47] Wilbert L. Pronovost, "An Experimental Study for Determining Natural and Habitual Pitch," Speech Monographs, IX (1942), pp. 111-123.

[48] Ibid.

[49] Snidecor, loc. cit.

[50] Silverstein, et al., loc. cit.

differences. That is, females tend to use shorter speech unit durations than males.

Several studies with regard to verbal content have been made which point out the differences in male and female conversations. Moore[51] strolled along Broadway in the early evening noting fragments of conversations he overheard and later classified these to show the predominant interests of the sexes as indicated by informal verbal expression. In doing this, he assumed that spontaneous conversation would, to a considerable extent follow the lead of a person's fundamental interests and enthusiasms. He found that men conversed most frequently about business, money, and amusement while women most often discussed clothes and decoration. Landis and Burtt[52] conducted a similar study in Columbus, Ohio, and obtained results similar to Moore's. They found that 49 per cent of male conversations centered around business topics while female conversations were most frequently about men (22 per cent), clothes (19 per cent), or other women (15 per cent). These authors suggested that the combination of the categories "men" and "women" into one category which they would label "people" would yield a total of 37 per cent and lend support to the notion that women are more

---

[51] Henry T. Moore, "Further Data Concerning Sex Differences," Journal of Abnormal and Social Psychology, XVII (July-September, 1922), pp. 210-214.

[52] N. H. Landis and H. E. Burtt, "A Study of Conversations," Journal of Comparative Psychology, IV (February, 1924), pp. 81-89.

interested in "people" than "things." Landis[53] is another author who investigated this topic, this time in London. His results were virtually identical to those of Moore[54] and Landis and Burtt.[55] Stoke and West took exception to the results of these four authors and to the method by which they were obtained.[56] They repeated the measures of conversational interests but attempted to control for occupation and age (using only college students), time of the conversations (night), sex of the persons involved (either all male or all female), place of the conversations (residences), social factors (fraternity and sorority members as opposed to non-affiliate college students), and race (using only Caucasians). Students, unknown to their fellow conversants, acted as recorders during "bull sessions." These authors concluded that when the above factors were controlled, the sex differences between conversational topics were rather small. Their results indicated that men still showed more interest in things and in sports while women showed more interest in personalities, cultural topics, and social items. Stoke and

---

[53]C. Landis, "National Differences in Conversations," Journal of Abnormal and Social Psychology, XXI (January-March, 1927), pp. 354-357.

[54]H. T. Moore, loc. cit.

[55]Landis and Burtt, loc. cit.

[56]Stuart M. Stoke & Elmer D. West, "Sex Differences in Conversational Interests," Journal of Social Psychology, II (February, 1931), pp. 120-126.

West felt that other differences, as indicated by the previous studies, were traceable to environmental influences. Carlson, Cook, and stromberg,[57] in turn, took exception to the results of Stoke and West[58] and their criticism of the previous studies. These three authors felt that the Stoke and West study[59] was not directly comparable to those of Moore,[60] Landis and Burtt,[61] and Landis,[62] because it used only college students as subjects. Carlson, Cook, and Stromberg used the same controls as Stoke and West[63] with the exception of age and found what they described as "clear sex differences" in the topics of money, business, and sports for men and other women and clothes for women.[64]

An investigation performed by Gleser, Gottschalk, and Watkins also falls within this area of interest.[65] They

---

[57]J. Spencer Carlson, Stuart W. Cook, and Elroy L. Stromberg, "Sex Differences in Conversation," Journal of Applied Psychology, XX (1936), pp. 727-735.

[58]Stoke and West, loc. cit.

[59]Ibid.

[60]H. T. Moore, loc. cit.

[61]Landis and Burtt, loc. cit.

[62]Landis, loc. cit.

[63]Stoke and West, loc. cit.

[64]Carlson, Cook, and Stromberg, loc. cit.

[65]Goldine C. Gleser, Louis A. Gottschalk, and John Watkins, "The Relationship of Sex and Intelligence to Choice of Words: A Normative Study of Verbal Behavior," Journal of Clinical Psychology, XV (April, 1959), pp. 182-191.

conducted a study of the relationship of sex and intelligence to choice of words in a free-speech situation and found that females used a significantly higher percentage of words implying feeling, emotion, or motivation. They also made significantly more references to self and used more auxiliary words and negations. On the other hand, females used a relatively smaller percentage of words implying time, space, or quality. They also used a smaller percentage of words referring to destructive action than did men.

In a similar kind of investigation, Penny studied the age and sex differences in the motivation toward conversation for teenage children.[66] He found that the conversations of boys of this age tended to be motivated by informational reasons while girls were motivated to converse for narcissistic reasons.

Another area of investigation with regard to differentiating between the aural characteristics of male and female speech has been in terms of speech power. Fletcher stated that speech power is measured in microwatts and is rated in terms of the intensity level of speech produced at one meter distance from the lips and directly in front of the speaker.[67] He reported a study performed by Dunn and

---

[66] R. Penny, "Age and Sex Differences in Motivational Orientation to the Communicative Act," Child Development, XXIX (December, 1958), pp. 163-171.

[67] Fletcher, op. cit., p. 52.

White who measured the total speech power used by each of six men and five women.[68] The average for the men was 34 microwatts (equivalent to 66.4 dB) while the women averaged 18 microwatts (equivalent to 63.4 dB). The total ranges for the male and female speakers, respectively, were ten to 90 microwatts and eight to 55 microwatts. Fletcher interpreted these findings to indicate that men and women's voices are quite alike in terms of the frequency-power distribution of speech.[69] However, he stated further that tests with a sound level analyzer indicated that the intensities or speech power of the components carried by frequencies above 3,000 cps were definitely greater for women's voices than for men's. He felt that this seemed to indicate that women gave greater emphasis to siblilant sounds.[70]

A further differentiating characteristic, variability of vocal pitch, has been studied by Snidecor.[71] He found that the voices of women were less variable in vocal pitch than those of men. This particular finding refers to both the extent of pitch variation when it occurs and to the rate of pitch changes per unit of time.

In addition, Dimitrovsky, in her doctoral dissertation, found that male and female speakers, while uttering

---

[68] Ibid., p. 75.

[69] Ibid., p. 78.

[70] Ibid.

[71] Snidecor, loc. cit.

neutral phrases, differed in the degree to which they were able to communicate specific emotional feelings to children.[72] Her male speakers, as indicated by listener identifications, communicated the feelings of "sadness" and "love" significantly better than did the female speakers. With regard to the emotional feeling of "anger," the situation was reversed.

On the basis of the investigations reviewed above, it appears possible to specify nine characteristics by which differentiation between male and female speech might be made on the basis of both content and vocal cues. The most obvious of these, of course, is that of vocal pitch. Additional cues, however, may be provided by: (1) intelligibility; (2) syllable duration; (3) speech power; (4) variability of vocal pitch; (5) accuracy of communication of emotional feelings; (6) conversational topics; (7) word choice; and (8) motivation for conversing. The present study, however, attempted to limit the cues available to the listeners to only the vocal type. That is, cues that are "content-free" from the standpoint of providing clues as to the sex of the speaker on the basis of the last three items above (conversational topics, word choice, and motivation for conversing). As indicated in Chapter I, and discussed more fully in Chapter III, the speech stimulus for making the spontaneous

---

[72] Lilly Sprecker Dimitrovsky, "The Ability to Identify the Emotional Meaning of Vocal Expression at Successive Age Levels," Dissertation Abstracts, XXIV (January, 1964), pp. 2983-2984.

(extemporaneous) speaker recordings was a written "neutral" paragraph. It is hoped that this method had the effect of controlling the verbal content of the speakers' extemporaneous utterances in this situation, while at the same time, not interferring with the strictly vocal content possibilities referred to above.

Age

Popular literature abounds in references to vocal changes associated with aging. An example is Jaque's description of the sixth age of man in Shakespeare's As You Like It: "His big manly voice, turning again toward childish treble, pipes and whistles in his sound." In the professional literature, however, such references are sparse.

Pear's radio listeners had little difficulty judging the ages of nine readers they heard over the air.[73] These results were supported by the findings of Allport and Cantril[74] and Herzog (as reported by Diehl)[75] who also obtained identifications of speaker age on the basis of voice by listeners with better than chance accuracy. However, the

---

[73]Pear, loc. cit.

[74]Gordon W. Allport and Hadley Cantril, "Judging Personality from the Voice," Journal of Social Psychology, V (February, 1934), pp. 37-55.

[75]H. Herzog, "Stimme und Personlichkeit," Ztschr. f. Psychol. CXXX (1933), pp. 300-369, cited by Charles F. Diehl, "Voice and Personality," Psychological and Psychiatric Aspects of Speech and Hearing, ed. Dominick A. Barbara (Springfield, Ill.: Charles C. Thomas, 1960), p. 180.

latter two of these three studies found a tendency for estimates of age to center in the thirties.[76,77] In a recent study, Ptacek and Sander tested the ability of ten graduate students in Speech Pathology and Audiology to differentiate the voices of young adults (under age 35) from those of older persons (over age 65).[78] These differentiations were required under three successive listening conditions of decreasing difficulty: (1) a prolonged vowel; (2) a tape recorded reading sample played backward; and (3) a tape recorded reading sample played forward. In the first two of these three conditions, content or semantic cues were removed. In the third condition, tape recorded reading samples played forward, the listeners were offered verbal or content cues as well as vocal cues. The results of the study indicated that this latter listening condition enabled the subjects to identify correctly which of the two age groups the speakers belonged to 99 percent of the time. While listening to a prolonged vowel, the subjects correctly identified the age group of the speakers 78 percent of the time. Under the second condition, tape recorded reading samples played backward, the subjects correctly identified the age group of

---

[76] Allport and Cantril, loc. cit.

[77] Herzog as cited by Diehl, loc. cit.

[78] Paul H. Ptacek & Erik K. Sander, "Age Recognition from Voice," Journal of Speech and Hearing Research, IX (June, 1966), pp. 273-277.

the speakers 87 percent of the time. The authors felt that the overwhelming success of the subjects in making these identifications precluded the need for statistics in analyzing the results.[79] Following the identifications, the authors asked the listeners to indicate the cues they used in making their differentiations. The most frequent of these were: (1) rate of reading; (2) fluency; (3) voice quality; (4) vocal pitch; and (5) vocal intensity. The listeners felt that the older speakers read slower than the younger group. Objective measures made by the authors indicated that the above age 65 group had a mean reading rate of 152 words per minute while the younger group read at a mean rate of 200 words per minute. In terms of the remaining four perceptual cues, the subjects felt that the older speakers were less fluent, had a hoarse voice quality with evidence of frequent vocal strain and voice breaks, used a lower pitch and less pitch variability and less vocal intensity.[80]

These results are very interesting when they are considered in conjunction with the results of various objective studies of the effects of aging upon voice and speech. Mysak, for example, investigated the pitch and duration characteristics of two groups of older males (ages 67-79 and

---

[79] Ibid.

[80] Ibid.

and 80-92) and their middle aged sons (aged 30-62).[81] He found that for this group the fundamental frequency of the voice tended to rise with age, pitch variability was increased with age, and reading and speaking rate was reduced as age increased. A significant contribution to this reduction in reading and speaking rate was found to be an increased number of pauses by the older speakers. This latter objective result supports both the subjective listener ratings and the objective measures made with regard to reading rate by Ptacek and Sander.[82] It also supports the subjective observations their listeners made with regard to fluency. However, Mysak's[83] objective measures of vocal pitch and pitch variability are in direct opposition to the subjective observations of Ptacek and Sander's[84] listeners.

Bach, Lederer, and Dinolt pointed out that degenerative changes in laryngeal muscles take place with advancing age and argued that these changes result in what they termed "senile voice."[85] On describing the senile voice, they

---

[81]Edward D. Mysak, "Pitch and Duration Characteristics of Older Males," Journal of Speech and Hearing Research, IX (March, 1959), pp. 46-54.

[82]Ptacek and Sander, loc. cit.

[83]Mysak, loc. cit.

[84]Ptack and Sander, loc. cit.

[85]A. C. Bach, Frances C. Lederer and R. Dinolt, "Senile Changes in the Laryngeal Musculature," Archives of Otolaryngology, XXXIV (July, 1941), pp. 47-56.

referred to "changes" in the pitch that render the voice monotonous, flat and occasionally shrill in older people." This statement, of course, is not consistent with those of Mysak who reported a trend toward greater pitch flexibility with advancing age.[86] In terms of the subjective comments made by Ptacek and Sander's listeners, it agrees with one portion, i.e., that older speakers speak with less pitch variability, but seems opposed to these listeners' comments to the effect that older speakers use a lower vocal pitch level than do the younger speakers.[87]

In another objective study of speech as it is affected by advancing age, McGlone and Hollien investigated the vocal pitch characteristics of aged women.[88] Their results provided no evidence that pitch levels vary significantly with advancing age once pubescent voice change is complete. The mean pitch levels used by their speakers, two groups of older women aged 65-78 and 80-94, did not rise with advancing age as did those for men of equivalent ages as reported by Mysak.[89] McGlone and Hollien offered an explanation for this discrepancy.[90] They felt that since the

---

[86]Mysak, loc. cit.

[87]Ptacek and Sander, loc. cit.

[88]Robert C. McGlone and Harry Hollien, "Vocal Pitch Characteristics of Ages Women," Journal of Speech and Hearing Research, VI (June, 1963), pp. 164-170.

[89]Mysak, loc. cit.

[90]McGlone and Hollien, loc. cit.

anatomical changes in the female larynx are not as extensive at puberty as are those in men, degenerative changes may not have as great an effect on women's laryngeal structures in later life. Hence, the concomitant changes in pitch, if present at all, would not be as apparent as they are in men.

Ptacek, et al., assessed the performance of younger adult (under age 40) and geriatric (over age 65) speakers on the following tasks in assessing phonatory and related changes with advanced age: (1) maximum pitch range; (2) diadochokinesis; (3) maximum vowel intensity; (4) maximum vowel duration; (5) maximum intraoral breath pressure; and (6) vital capacity.[91] Their investigation was designed primarily to explore certain changes associated with advanced age in the functioning of the respiratory, phonatory, and articulatory apparatus subserving speech. The results indicated that on all of the above named tasks, the geriatric subjects showed significantly reduced scores when compared with those of the younger adults. These results are again generally consistant with the subjective statements by the judges used by two of these authors in a previous study[92] and with the objective results obtained by Mysak[93] with regard to older males, and with the observation of Bach,,

---

[91] Paul H. Ptacek, et al., "Phonatory and Related Changes with Advanced Age," Journal of Speech and Hearing Research, IX (September, 1966), pp. 353-360.

[92] Ptacek and Sander, loc. cit.

[93] Mysak, loc. cit.

Lederer and Dinolt[94] with regard to anatomical and physiological changes in the larynx with advanced age.

In addition to the studies reported above which were concerned with primarily the vocal aspects of speech as it is affected by the age of the speaker, there have been several studies with regard to the content or verbal aspects. Bloomer, for example, believed that the geriatric speaker has difficulty in all forms of "verbal communication," a term which he felt implies for the aging a somewhat broader conception of spoken and written language than is typically employed.[95] He felt, that within this broad context, verbal behavior underlies most of our orientations in daily living--and, it is in this sense that the communication problems of the aging reveal themselves. Bloomer felt that practically all of our psychosocial activities are mediated through the use of one of the major linguistic modalities--speech, listening, writing, or reading, and in addition to these modalities, we must include a number of simple daily tasks, e.g., telling time, making simple arithmetic calculations, and making change in the purchase of articles, all of which require a personal competency on the part of the individual

---

[94]Bach, Lederer and Dinolt, loc. cit.

[95]Harlan Bloomer, "Communication Problems among Aged County Hospital Patients," Geriatrics, XV (April, 1960), pp. 291-295.

to interpret the signs and symbols of life about him. In a survey of institutions for the aged, Bloomer found that the elderly person is much more prone to develop communicative disorders than is the younger adult.[96]

His results indicated that 45 per cent of the institutionalized population he surveyed had some kind of communicative disorder. This incidence figure he contrasted with the usual two per cent found in a random adult population and indicated, in addition, that these disorders usually differ in etiology, prognosis, and their effect upon the total psycho-social adjustment of the person involved. The etiology according to Bloomer[97] and Mitchell[98] is usually related to the degenerative process. Specifically, Bloomer found the following communicative problems in the population he surveyed:[99] (1) aphasia associated with cerebrovascular accidents; (2) verbal evidence of mental confusion; (3) dyslalia and dysarthria; and (4) dysphonia associated with general physical debility, paresis, personality withdrawal symptoms, or a psychosis such as schizophrenia. In addition,

---

[96] Ibid.

[97] Ibid.

[98] Joyce Mitchell, "Speech and Language Impairment in the Older Patient," Geriatrics, XIII (July, 1958), pp. 467-476.

[99] Bloomer, loc. cit.

both he and Mitchell[100] reported that the high incidence of hearing loss in the geriatric patient (35 per cent as opposed to seven per cent in a random adult population) is also a significant factor in the communicative problems of the aged.

Investigations of vocabulary ability over the life span include works covering the period of later maturity. Results range from vocabulary loss (Ackelsberg,[101] Brown,[102] Shakow, Dolkert, and Goldman,[103] and Shakow and Goldman[104]) to vocabulary growth (Christian and Patterson[105] and Sorenson[106]) among older people: some investigators have

---

[100]Mitchell, loc. cit.

[101]Sylvia A. Ackelsber, "Vocabulary and Mental Deterioration in Senile Psychosis," Journal of Abnormal and Social Psychology, XXXIX (October, 1944), pp. 393-406.

[102]Mary Matrow Brown, "A Study of Performance on a Deterioration Test Related to Quality of Vocabulary and Rigidity," American Psychologist, III (October, 1944), pp. 393-406.

[103]D. Shakow, Marjorie B. Dolkart, and Rosaline Goldman, "The Memory Function in Psychosis of the Aged," Disorders of the Nervous System, II (January, 1941), pp. 3-8.

[104]D. Shakow & Rosaline Goldman, "The Effect of Age on Stanford-Binet Vocabulary Scores of Adults," Journal of Educational Psychology, XXIX (April, 1938), pp. 241-256.

[105]Alice M. Christian and Donald G. Patterson, "Growth of Vocabulary in Later Maturity," Journal of Psychology, I (1936), pp. 167-169.

[106]H. Sorenson, "Mental Ability over a Wide Range of Adult Ages," Journal of Applied Psychology, XVII (1938), pp. 729-741.

reported no change (Fox,[107] Hunt, et al.,[108] and Fox and Birren[109]). These latter authors have been particularly critical of the studies which have shown vocabulary changes with increasing age.[110] They found no relation between vocabulary size and either age or length of institutionalization for a population of persons over 40 years of age. In addition, they found no significant sex differences in vocabulary size at any age within this population when educational levels were equated. An investigation by Ricks, however, of the age and vocabulary test performance of the age groups 25-29, 45-49, 70-74, and 75 and above, contradicts these findings.[111] Ricks used the vocabulary subtest of the Wechsler Adult Intelligence Scale and found that older adults averaged significantly lower in the use of synonyms in defining words, averaged significantly higher in terms of defining words by means of "use and description,"

---

[107]Charlotte Fox, "Vocabulary Ability in Later Maturity," Journal of Educational Psychology, XXXVIII (December, 1947), pp. 482-492.

[108]W. A. Hunt, et al., "The Clinical Possibilities of an Abreviated Individual Intelligence Test," Journal of Clinical Psychology, XII (February, 1948), pp. 171-173.

[109]Charlotte Fox and James E. Birren, "Some Factors Affecting Vocabulary Size in Later Maturity: Age, Education, and Length of Institutionalization," Journal of Gerontology, IV (January, 1949), pp. 19-26.

[110]Ibid.

[111]James H. Ricks, "Age and Vocabulary Test Performance: A Qualitative Analysis of the Responses of Adults," Dissertation Abstracts, XIX (July, 1958), p. 182.

i.e., interior definitions, and scored significantly higher in defining words erroniously than did the younger groups. This author interpreted these results as challenging the hypothesis that the vocabulary score of an older person can be regarded as reflecting performance in which little or no change has occurred since early adulthood. Rather, "they support the contention that impairment does occur."[112]

In a related study, Birren, Riegel, and Robbin investigated the speed of word associations made by two groups of subjects, one aged 18-33 years and another aged 60-80 years.[113] These subjects were comparable in the number of years of completed formal education and vocabulary size. The obtained data showed an age difference in mean latency of word associations of about 0.6 seconds per word, or about 40 per cent longer for the older group.

In summary, it appears, from evidence cited above, that a speaker's age can be judged with better than chance accuracy from his voice. However, the specific vocal cues that listeners have reported using is not clearly consistent with objective measures that have been made attempting to differentiate between the vocal aspects of speech as a function of age. Moreover, this same inconsistency of

---

[112] Ibid.

[113] James E. Birren, K. F. Riegel, and J. S. Robbin, "Age Deficiencies in Continuous Word Associations Measured by Speech Recordings," Journal of Gerontology, XVIII (January, 1962), pp. 95-96.

reported results is evident from the standpoint of content or verbal differences.

Ethnic Group

Investigations as to the ability of listeners to identify the ethnic group of speakers have been sparse. The same can be said of objective studies in which an attempt is made to specify various vocal or conversational cues by which to make such differentiations. One study of the subjective evaluations of listeners investigated whether or not Jewish and Gentile subjects exhibited differential reactions to the same speaker when he was using English with a Jewish accent.[114] Results indicated that persons with an accented voice were devaluated on height, good looks, and leadership by both listener groups. The Jewish subjects tended to evaluate the accented voice more favorably on sense of humor, entertainingness, and kindness. However the Gentiles did not evaluate the accented voice as being more favorable on any trait.

These results offer support to a statement by Allport and Kramer.[115]

---

[114]M. Ainsfield, N. Bogs, and W. Lambert, "Evaluational Reactions to Accented English Speech," Journal of Abnormal Psychology, LXV (1962), pp. 223-231.

[115]Gordon W. Allport and Bernard M. Kramer, "Some Roots of Prejudice," Journal of Psychology, XXII (1946), pp. 9-39.

> The question of racial identity is of small importance to the person free from prejudice, yet it is of considerable importance to the bigot, and for this reason, the bigot apparently learns to observe and interpret both facial features and expressive behavior so that he can more swiftly spot his "enemy."

Cohen and Starkweather, in a study investigating whether subjects with high scores in ethnocentric prejudices were more sensitive to the cues provided by the expressive behavior of various ethnic groups, found that the vocal portion of speech, i.e., with verbal content removed by filtering, carries information which allows English speaking subjects to distinguish between English and non-English speech to a degree which exceeded that which would have been expected by chance.[116]

With specific reference to the ethnic group of interest in the present study, Wise has stated, "Offhand, one would say that southern Negro speech is of all the dialects the most strikingly different from cultivated English.[117] He felt, in addition, that many of these differences are not articulatory or enunciatory and are not therefore, easily reducible to phonetic terms. With regard to enunciation, Wise wrote that enunciation "tends to be lax and careless."[118] He also pointed out four primary ways in

---

[116]Alan Cohen and John A. Starkweather, "Vocal Cues to the Identification of Language," American Journal of Psychology, LXXIV (March, 1961), pp. 90-93.

[117]C. M. Wise, "Negro Dialect," Quarterly Journal of Speech, XIX (November, 1933), pp. 522-528.

[118]Ibid.

which the Southern Negro differs in articulation from "cultivated English."[119] (1) vocabulary ("various word substitutions"); (2) declension; (3) intonation ("one of the outstanding characteristics of Negro speech"); and (4) tongue placement ("the characterizing element of Negro speech"). In terms of the last point, Wise felt that Negroes consistently use a more elevated tongue placement than is usual in cultured English. He felt that this articulatory difference accounted for what he described as "a characteristic Negro voice quality" in which vowels "become somewhat open and free."[120] While he felt that this tongue placement may possibly be a heritage from the original African speech, Wise did not believe that it resulted from any peculiar physical formation of Negro resonance cavities. To support this, he pointed out that Negroes reared among a majority of Caucasians, e.g., Negroes living in the North, "have nothing of the Negro voice quality."[121] With specific reference to this phenomenon, Wise stated:[122]

> When in relatively complete isolation from large numbers of their race who are either fresh from the South or who have preserved their southern voices by reason of social segregation and forced association with their own kind, these northern Negroes can not be distinguished from White people through

---

[119] Ibid.

[120] Ibid.

[121] Ibid.

[122] Ibid.

any voice characteristic. The test of the telephone in northern cities repeatedly proves this.

An additional differentiating characteristic of southern Negro speech was felt to be a limited amount of nasal resonance in comparison with Caucasian speech.

In an objective investigation of the characteristics of Negro speech, Hollien and Malick[123] duplicated a previous study of the vocal pitch characteristics of northern Caucasian males by Curry[124] using southern Negroes. Results indicated that for 18 year olds, i.e., post adolescents, southern Negro males display a lower median pitch level than do northern Caucasian males. These pitch levels for the perspective groups and their approximate equivalent musical tones were 124.4 cps (B_3) for Negro speakers and 137.1 cps (C3), for the Caucasian speakers.[125]

This obtained difference in pitch level is consistent with findings of Bosohoff.[126] He reported that the larynges of his Negro cadavers were somewhat larger on the average than those of his Caucasian cadavers.

---

[123]H. Hollien and Ellen Malick, "Adolescent Voice Change in Southern Negro Males," Speech Monographs, XXIX (March, 1962), pp. 53-58.

[124]E. T. Curry, "The Pitch Characteristics of the Adolescent Male Voice," Speech Monographs, VII (March, 1940), pp. 48-62.

[125]Hollien and Malick, loc. cit.

[126]P. H. Boshoff, "The Anatomy of the South African Negro Larynges," South African Journal of Medical Science, X (February, 1945), pp. 35-40.

In another objective study, this time with regard to more general language functioning, Carson and Rabin investigated verbal comprehension and communication in Negro and Caucasian children from 9.5-11.5 years of age.[127] Their subjects were matched on age, grade in school, sex, and verbal comprehension as measured by the Full Range Picture Vocabulary Test. The results indicated that northern Caucasian children, even though matched as described above, manifest higher levels of verbal communication than northern Negro children, and, in turn, the latter group manifest higher levels of verbal communication than southern Negro children. The criterion measure for the verbal communication scores were the WISC vocabulary subtest and a specially constructed verbal version of the Full Range Picture Vocabulary Test.

It appears possible, on the basis of the studies reviewed above, to make several tentative observations with regard to listener differentiation between the Caucasian and Negro ethnic groups. First of all, it has been shown that listeners can differentiate between (1) English and non-English speakers even though verbal content has been

---

[127] Arnold S. Carson and A. I. Rabin, "Verbal Comprehension and Communication in Negro and White Children," Journal of Educational Psychology, LI (April, 1960), pp. 47-51.

removed,[128] and (2) Jewish accented speech and "pure" English speech.[129]

Secondly, several possible characteristics by which listeners might differentiate between Negro and Caucasian speech have been suggested. Among these are vocabulary, declension usage, vocal intonation, voice quality, nazalization, vocal pitch, and general verbal communicative ability. Despite these cues, however, and the general successes pointed out above, there is no evidence that listeners can actually make the distinction in question in the present study. In fact, it has been suggested that the task is not possible where northern residents of the two ethnic groups are concerned.[130]

Education

Not one study was encountered which investigated whether or not listeners could identify the education levels of speakers on the basis of aural cues. However Fay and Middleton have investigated the identificability of related characteristics from the voice as transmitted over a public address system. In one of the studies, these authors asked 84 undergraduate college students to judge the intelligence of third and fourth year high school boys on the basis of a

---

[128] Cohen and Starkweather, loc. cit.

[129] Ainsfield, Bogs, and Lambert, loc. cit.

[130] Wise, loc. cit.

thirty second oral presentation of "interesting reading material."[131] The speakers were selected on the basis of I.Q. as measured by the Terman Group Test of Mental Ability and were matched in oral reading ability. The results indicated that the listeners tended to judge the I.Q. group to which speakers belonged relatively well but not to a degree that was significantly better than chance. In the second study referred to above, Fay and Middleton tried to determine whether or not leadership ability could be accurately judged from the transmitted voice.[132] Fifteen speakers, all from one fraternity, were used. Ten seniors who had known each of the speakers for a period of at least six months rated them for leadership qualities on a seven point scale (minus three to plus three). The interjudge reliability of these ratings was + .91. The mean for each speaker was used as his criterion. Twenty-eight undergraduates then rated leadership on the same scale on the basis of hearing the speakers read a 30 second sample of a selection from a magazine. The obtained correlation between each speaker's leadership criterion and his rating by listeners was + .08. Fay and Middleton concluded that the performance of listeners in accurately

---

[131] Paul F. Fay and Warren C. Middleton, "Judgment of Intelligence from the Voice as transmitted over a Public Address System," Sociometry, III (April, 1940), pp. 186-191.

[132] Paul F. Fay and Warren C. Middleton, "Judgment of Leadership from the Transmitted Voice," Journal of Social Psychology, XVII (1943), pp. 99-102.

judging leadership abilities from voice, relative to a criterion, was about what would be expected by chance.

In another study relating intelligence to oral expressive behavior, Gleser, Gottschalk, and Watkins investigated the relationship of this factor and sex to choice of words in a free-speech situation.[133] They found that I.Q. differences occurred primarily among gramatical categories. The proportional use of adjectives (including articles), articles alone, prepositions, auxiliary words, and words referring to quality or state of being increased sharply with increased intelligence. Interestingly enough from the standpoint of the present study, Gleser, Gottschalk, and Watkins suggested that their obtained differences in the verbal behavior of their subjects might well not have been due to intelligence differences alone.[134] They performed a product-moment correlation between the intelligence and educational level of each of the subjects and obtained an r equal to + .72. These authors felt, on the basis of the evident strength of this relationship, that the obtained differences in verbal behavior might well reflect differences in educational background instead of, or as well as, I.Q. level.

Johnson has also done an objective study within the general area of speech characteristics of persons of different educational and experience backgrounds. He found that

---

[133] Gleser, Gottschalk, and Watkins, loc. cit.

[134] Ibid.

experienced business executives scored significantly higher in English vocabulary than did recent college graduates, both in business and general academic areas, and non-college graduates.[135] Johnson concluded that a large vocabulary is a characteristic of a high ranking business executive and that this characteristic is independent of past educational experience.

In another vocabulary study, Schulman and Havinghurst investigated this factor in relation to social status in what they described as "a representative midwestern community."[136] They found that, on the average, children of higher social status made higher mean scores on the Seashore-Eckerson English Recognition Vocabulary Test than did children of lower status. In a similar study, Rosenthal investigated whether or not differences existed in the language behavior of children who belong to high and low sociometric groups.[137] His subjects were second grade children who were matched on intelligence, sex and age. Language samples were

---

[135]A. P. Johnson, "A Study of the English Vocabulary Scores of 75 Executives," Technical Report of the Human Engineering Laboratory, No 2 (1935), p. 16.

[136]Mary Jean Schulman and Robert J. Havinghurst, "Relations Between Ability and Social Status in a Midwestern Community. IV: Size of Vocabulary," Journal of Educational Psychology, XXXVIII (November, 1947), pp. 437-442.

[138]Ered Rosenthal, "Some Relationships Between Socio-Position and Language Structure of Young Children," Journal of Educational Psychology, XLVII (December, 1957), pp. 483-497.

collected by means of conversations with an adult. They were analyzed on the basis of: (1) structure; (2) method; and (3) communicative value. The sociometric status of each subject was determined by means of sociographic methods. Results indicated that children of high sociometric status tend toward language characterized by a high percentage of meaningful communication. Rosenthal found that their communication took place in longer units and that they manifested shorter and fewer aspects of what he termed "noise" in language.[138] These subjects also used a larger number of verbs relative to adjectives and a greater variety of words. On the other hand, his children of low sociometric status tended toward language characterized by a smaller percentage of meaningful communication. Their communication was also in shorter units. In addition, the low sociometric group used a greater number of "noise" aspects, more adjectives related to verbs and less variety in the type of words.

In studies of social class and speech systems, Bernstein has suggested three main areas of linguistic difference between middle class and lower working class boys.

1. In working class samples particular relationships were found between verbal and non-verbal I.Q. scores; the verbal scores tended to be depressed in relation

---

[138] Ibid.

to the scores obtained at the higher ranges of the non-verbal test.[139]

2. Class differences in terms of modes of verbal expression were found to exist on both a lexical and grammatical basis in the sense that working class speech is selected from a more narrow range of alternative structures.[140]

3. Two different speech systems were considered to be generated through the use of different verbal planning procedures. These differences existed not only in syntatic selection but also in mean pause duration per word.[141]

Bernstein's theoretical basis for these studies was the postulated existances of two linguistic codes: restricted and elaborated, the lower working class tending to be confined to the former with the middle class group switching from one to the other according to the context.[142] According to this author, a restricted code is generated by a

---

[139]Basil Bernstein, "Language and Social Class," British Journal of Sociology, XI (1960), pp. 271-276.

[140]Basil Bernstein, "Social Class Linguistic Codes and Grammatical Elements," Language and Speech, V (1962), pp. 221-240.

[141]Basil Bernstein, "Linguistic Codes, Hesitation Phenomena, and Intelligence," Language and Speech, V (1962), pp. 31-45.

[142]Bernstein, "Social Class Linguistic Codes and Grammatical Elements."

form of social relationship based upon a range of closely shared identifications held by the members. An elaborated code is generated by a form of social relationship which does not necessarily presuppose such shared identifications with the consequence that much less is taken for granted. Each code regulates the "area of discretion" available to a speaker and so differently constrains the limits of verbal behavior.[143] The community of like interests underlying a restricted code removes the need for intent to be verbally elaborated and made explicit. The effect of this on speech is to simplify the structural alternatives used to organize meaning and restrict the range of word choice. A restricted code can arise at any point in society where its conditions may be fulfilled but the special case of its use by the working class is that the speaker is limited to this code. An elaborated code is the realm of the middle class; a middle class individual simply has access to the two codes. The lower class individual has access to only one.

As indicated above, Bernstein's studies have shown that the two class groups are differentially oriented in both their structural selections toward choices. Furthermore, when the subjects representing the two social groups are subdivided within each group on the basis of intelligence, the differences between the working class and middle class still hold up. Bernstein felt that this fact indicated

---

[143] Ibid.

that the two social groups are oriented differently toward language independent of intelligence.[144]

Following Bernstein's theoretical structure and research findings, Lawton investigated the characteristics of working class and middle class written language.[145] His results indicated that the characteristics of Bernstein's restricted code carry over into writing "to a far greater extent than might be expected."[146] The consistency of results showed that inter-class differences exist not only in vocabulary, but also in whole classes of words (adjectives, adverbs, pronouns), and in structure (passive verb forms and types of subordination). In each case, working class subjects, restricted code users, select words and structure from a narrower choice of alternatives.

In terms of summarizing the information relative to speech characteristics available to listeners in differentiating between speakers of differing educational backgrounds, the above reviewed studies are valuable only to the degree that intelligence, leadership qualities, vocational success, and social status are related to this factor. The

---

[144]Bernstein, "Linguistic Codes, Hesitation, Phenomena, and Intelligence."

[145]Denes Lawton, "Social Class Differences in Language Development: A Study of Some Samples of Written Work," Language and Speech, XI (1963), pp. 120-143.

[146]Ibid.

The relationship between intelligence and educational level has already been pointed out.[147]

In terms of relating leadership qualities with education, Hollingworth has pointed out that "one indispensable quality of leadership" is extraordinary intelligence.[148] This statement has been supported by the results of a study by Reynolds who investigated the characteristics of leaders and non-leaders among senior high school students.[149] He found that students designated as leaders among a group tended to be superior to non-leaders in achievement, intelligence, and personality rating.

With regard to the relationship between vocational success and educational level, Glick and Miller found that both the average annual incomes and the projected life incomes of adult males increases with increased formal educational experience.[150] They found, in 1949, that the annual income from a male with eight years of formal schooling was $3,112. By contrast, the yearly income for the same age male

---

[147]Gleser, Gottachalk, and Watkins, loc. cit.

[148]L. S. Hollingworth, "What We Know About the Early Selection and Training of Leaders," Teachers College Record, XL (April, 1939), pp. 575-592.

[149]F. G. Reynolds, "Factors of Leadership Among Seniors of Central High School, Tulsa, Oklahoma," Journal of Educational Research, XXXVII (January, 1964), pp. 356-361.

[150]Paul C. Glick and Herman P. Miller, "Education level and Parental Income," College Board Review, No. 32 (1957), pp. 29-32.

with a high school diploma was $4,519, while this figure for the college graduate was $7,907. While these figures in themselves carry some additional implications in terms of the relationship between social status and educational attainment, the number of studies showing amore direct positive relationship between these two factors are numerous. Blake, for example, investigated the relationship between socio-economic status (as measured by the Sims Score Card for Socio-economic Status when the subjects were 12 years of age) and scholastic apptitude and intelligence (as measured by the Miller Analogies Form G, the Cattell Culture-Free Intelligence Test, and the American Council on Education's Psychological Examination, 1941, when the subjects were in college).[151] Significant correlations were obtained between all measures. In addition, educational and occupational levels of the parents of the subjects showed a "pronounced positive relationship with high intelligence test scores" made by their children. Blake concluded that the residual effects of childhood socio-economic status were reflected in high school scholastic apptitude and intelligence test performance of his young adult subjects.[152] In another study,

---

[151]Robert R. Blake, "The Relationship Between Childhood Environment and the Scholastic Aptitude and Intelligence of Adults," Journal of Social Psychology, XXIX (February, 1949), pp. 37-41.

[152]Ibid.

Sewell, Haller, and Straus found that the educational and occupational aspirations of college students from non-farm families was a function of the social status of their families, over and above the factor of intelligence.[153] This relationship between intelligence test performance and social class status has been explored by several authors. Britton found significant correlations (ranging from + .42 to + .53) between the social status of 102 boys and 130 girls and their scores on the Hennon-Nelson, the Otis Aspha Verbal and Non-Verbal and the Kuhlmann-Anderson tests of intelligence.[154] In addition, Havinghurst has pointed out that when the upper middle class is compared with the lower class, it becomes evident that there are systematic differences in the experiences of children of these groups that might be expected to result in different levels of performance on the ordinary intelligence tests.[155] He felt that these differences were cultural in nature and that they fell into four areas: (1) cultural differences in home and family; (2) cultural differences in neighborhood and community life; (3) cultural

---

[153]William H. Sewell, Archie O. Haller, and Murray A. Straus, "Social Status and Educational and Occupational Aspiration," American Sociological Review, XXII (February, 1957), pp. 67-73.

[154]Joseph H. Britton, "Influence of Social Class upon Performance on the Draw-a-Man Test," Journal of Educational Psychology, XLV (January, 1954), pp. 44-51.

[155]Robert J. Havinghurst, "Culture and the I.Q.," Purdue University Studies in Higher Education, No. 69 (1949), pp. 42-53.

differences in school experience; and (4) cultural differences in motivation for test performance. Toward this end, Stenquist and Lorge have pointed out that both test-makers and test-users must be aware that measures of intelligence and social status are highly related.[156]

Finally, with regard to the social class-educational level relationship, Bernard found a positive correlation between these two factors which he felt appeared to be the result of the differences in the perception characteristics of the members of the various social classes.[157] He felt that these perceptual differences facilitate educational attainment in middle class youth but inhibit it in working class youth because schools emphasize the abilities manifestly developed in the former group.

Based on the illustrated relationships between each of these characteristics, i.e., intelligence, leadership, vocational success, and social status, and educational level or attainment, it would appear possible that discriminations between members of different educational groups on the basis of aural cues might be made in terms of (1) grammatical categories; (2) evident vocabulary size; (3) length of speech

---

[156]John L. Stenquist and Irving Lorge, "Implications of Intelligence and Cultural Differences: As Seen by a Test-User; As Seen by a Test-Maker," Teachers College Record, LIV (January, 1953), pp. 184-193.

[157]B. Bernard, "Some Sociological Determinants of Perception: An Enquiry into Sub-Cultural Differences," British Journal of Sociology, IX (1958), pp. 159-174.

units; (4) frequency of reference to self; and (5) sentence structure.

Physical Size

From the literature it would appear that very little has been done relative to listener judgments of the physical characteristics of speakers. The same was found to be true in terms of possible differentiating aural features.

In a pair of similar studies, Barta[158] and Tursky[159] had listeners match the photographs of speakers to the voices they heard from behind a screen. In both studies the speakers were chosen in accord with Kretchmer body types. Each author reported results that indicated that the pyknic type was accurately evaluated. In both studies, the listeners' evaluations were least accurate in judging the athletic type.

In another study, Herzog[160] had 2,700 radio listeners in Vienna judge the height and weight of radio speakers. She found that both items were judged "more accurately than

---

[158]B. Barta, Ausdruck der Personlichkeit in der Sprechstimme und im Photogramm," Arch. Ges. Psychol. XCIV (1935), pp. 501-570, cited by Charles F. Diehl, "Voice and Personality," Psychological and Psychiatric Aspects of Speech and Hearing, ed. Dominick Barbara (Springfield, Ill.: Charles C. Thomas, 1960), p. 180.

[159]H. Tursky, "Zur Phenomenologie des Zuordnungsacktes zwischen Stimme und Bild des Sprechers," Wiener Dissertation, 1932, cited by Charles F. Diehl, "Voice and Personality," Psychological and Psychiatric Aspect of Speech and Hearing, ed. Dominick Barbara (Springfield, Ill: Charles Thomas, 1960), p. 180.

[160]Herzog, cited by Diehl, loc. cit.

one might expect from the mere operation of chance." In another of the Fay and Middleton[161] studies, this one involving listener judgements of Kretchmerion constitutional types based on the voice as transmitted over a public address system, results similar to those of Barta[162] and Tursky[163] were found. All body types studies were found to be accurately identified beyond what was expected by chance. The authors felt that the pyknic and leptsomatic types were apparently the least difficult to judge.

A study by McGehee,[164] however, contradicts the results obtained in the investigations reviewed above. He found poor results in listener estimations of height and weight on the basis of recorded oral readings. In addition, Diehl[165] found that listeners were unable to identify the height and weight of 110 speakers from a college population with accuracy that exceeded chance expectations. He concluded

---

[161]Paul J. Fay and Warren C. Middleton, "Judgment of Kretschmerian Body Types from the Voice as Transmitted over a Public Address System," Journal of Social Psychology, XXI (January, 1940), pp. 151-162.

[162]Barta, cited by Diehl, loc. cit.

[163]Tursky, cited by Diehl, loc. cit.

[164]F. McGehee, "An Experimental Study of Voice Recognition," Journal of General Psychology, XXXI (January, 1944), pp. 53-65.

[165]Charles F. Diehl, "Voice and Personality," Psychological and Psychiatric Aspects of Speech and Hearing, ed. Dominick Barbra (Springfield, Ill.: Charles C. Thomas, 1960), p. 183.

that the "probability of judging height and weight from the recorded voice . . . appears to be extremely poor."

As indicated above, the literature is sparse with regard to suggesting vocal features that might be useful in making differentiations between physical characteristics of speakers. For this reason, the writer has taken available literature and made what appeared to him to be logical speculations with specific reference to "big" and "small" speakers as defined in this study. For example, Fletcher[166] has reported that the average speech power used by men to 34 microwatts while the speech power used by women averages 18 microwatts. Applying this information to the characteristic of physical size, one might expect the same kind of difference, although not to the same degree, between very big and very small speakers.

From a logical standpoint, a difference between big and small male speakers might also be expected in vocal pitch. Specifically, one might expect the big speakers to have lower pitch than the small speakers. This line of thinking is supported by the research findings of Hollien[167] and Hollien and Curtiss[168] who found that low pitched speakers exhibit longer vocal folds than do individuals with higher pitch levels. This was found to be true both between and within the sexes.

---

[166]Fletcher, op. cit., p. 76.

[167]Hollien, loc. cit.

[168]Hollien and Curtiss, loc. cit.

Further support is provided by Fisher who stated that pitch differences between males and females is due to the differences in the length of their vocal folds.[169] In addition, Hahn et al.,[170] mentioned three factors important in determining vocal pitch that may be related to physical size: (1) length; (2) thickness; and (3) density.

In terms of resonance, similar thinking can be folfowed. Big speakers would be expected to have slightly larger resonating cavities than small speakers, thus amplifying lower pitched tones than the resonating cavities of the latter group.

Summarizing this section, there have been conflicting results with regard to listeners identifying the physical characteristics of speakers. In general, it appears that the more specific the identification requested, i.e., judging height and weight as opposed to body build, the less accurate the performance of listeners. In terms of differentiating vocal features, it has been suggested that big speakers may speak with more intensity and with a lower pitch than small speakers.

Dialect Region

The United States has traditionally been divided into three inclusive speech regions; (1) New England, (2) the

---

[169]Fisher, op. cit., p. 116.

[170]Hahn, et al., op. cit., pp. 57-58.

South, and (3) the remainder of the country. The labels attached to the first two regions from the outset of interest in this area have been Eastern and Southern speech, respectively.[171] Labeling of the third region has not been as consistent. The South is inclined to call it Northern speech, an obvious misnomer as, geographically, New England also lies far north and, in terms of speech, portions of the region, e.g., northern Texas and California, lie far south. Other labels that were suggested are Midwestern speech and Western speech.[172,173] These terms were considered inappropriate for the same reasons. North-and-West was another label that was suggested[174] and though it had merit in terms of being nearly consistent with the other geographical regions, East and South, it apparently did not catch on. The term that was finally accepted, General American speech, has the same geographical drawbacks as those labels described above in addition to giving the false connotation that it applies to the whole North American Continent.

---

[171] Claude Merton Wise, Introduction to Phonetics (Englewood Cliffs, N.J.: Prentice-Hall, 1958), p. 171.

[172] Ibid.

[173] Albert C. Baugh, History of the English Language (New York: Appleton-Century, 1935), p. 446.

[174] Hans Kurath, "Dialectal Differences in Spoken English," Modern Philology, XXVI (May, 1928), pp. 386-393.

According to Wise,[175] the first person to use this term was Windsor P. Doggett in the early 1920's. The occasion was an address by Doggett at the National Association of Teachers of Speech in New York.

The three all-inclusive speech regions of the United States are called, then, in order of size and population, General American, Southern, and Eastern.[176]

Wise[177] defined these speech areas as follows. The Eastern dialect region is bounded on the west by the Green Mountains and the Connecticut River. On the north this region is, of course, bounded by Canada, while on the east and south by the Atlantic Ocean and Long Island Sound. The boundary between the Southern speech region and the rest of the country begins on Delaware Bay at approximately the latitude of Dover and swings in a semicircle north of Baltimore and then southward to cross the Potomac a little below Harper's Ferry. Then it follows the Blue Ridge to its extremity and swings westward. At this point, data breaks off. The General American region, as indicated above, includes the remainder of the country. These descriptions are consistent with those contained in the Linguistic Atlas of the United States.[178]

---

[175]Wise, op. cit., p. 172.

[176]Ibid.

[177]Wise, op. cit., p. 178.

[178]Hans Kurath, Linguistic Atlas of the United States (Providence, R.I.: Brown University Press, 1939-1943).

Gray and Wise[179] described the Eastern speech region as including New England, and the city of New York, with some deviations. They also indicated that in some ways particularly in word selection, the influence of the East affects the speech of upstate New York and the northern third of Pennsylvania. These authors stated that the Southern dialect is spoken in those states which formed the Confederacy, with certain additions (Kentucky, southern Delaware, and southeastern Maryland), and with certain subtractions (the southern Appalachian highlands and the highlands of Arkansas and Louisiana, and all of Texas except a relatively small southeastern portion).

Many writers have discussed the differentiating characteristics of the three American English dialects with reference to pronunciation of the vowels. These sounds are discussed below under the conventional groupings.

Front Vowels.--For this group of sounds, Akin[180] cited only the Eastern substitution of the sound [a] for [æ] used by the rest of the country in such words as "fad" and "hat." Hahn, et al.,[181] mentioned this same substitution and in addition, indicated that the [a] is also often used

---

[179]Giles Wilkerson Gray and Claude Merton Wise, The Bases of Speech (New York: Harper and Brothers, 1959), p. 258.

[180]Johnnye Akin, And So We Speak: Voice and Articulation (Englewood Cliffs, N.J.: Prentice-Hall, 1958), p. 27.

[181]Hahn, et al., op. cit, p. 154.

in place of [ɑ] by Eastern speakers in such words as "art" and "garden." Wise[182] described the use of [a] by Eastern speakers as did Akin[183] but also added that Southern speakers sometimes use this sound in pronouncing the pronoun "I."

Central Vowels.--According to Akin,[184] the central vowels of interest in terms of dialect are [ɝ, ɜ, ɚ,] and [ə]. She stated that General American speakers tend to pronounce the "r" wherever it occurs orthographically. In Southern and Eastern speech, however, this sound may be pronounced as a one-tap trill [ɾ] as in "very"; as [ə] as in "sister," [sɪstə]; or it may be silent as in "far," [fɑ]. Hahn, et al., described the [ɜ] as the "r" used by speakers who drop their "r's."[185] They also stated that this sound becomes [ə] in the unstressed position.

Back Vowels.--For this set of sounds, Akin[186] indicated that the [ɑ] in the General American pronunciation of "war" becomes [ɔ] when uttered by a Southern speaker, and [ɒ] when uttered by an Eastern speaker. These observations were not supported by either Wise[187] or Hahn, et al.[188]

---

[182]Wise, op. cit., p. 102.

[183]Atkin, loc. cit.

[184]Akin, op. cit., pp. 63-68.

[185]Hahn, et al., op. cit., p. 158.

[186]Akin, op. cit., p. 34.

[187]Wise, op. cit., p. 104-105.

[188]Hahn, et al., op. cit., p. 155.

Several variations in the pronunciation of the General American [ɔ] were also noted by Akin.[189] She indicated that while General American speakers use this sound in "dog," and "soft," Eastern speakers most often substitute [ɒ]. In addition, Southern speakers often expand the [o] by the addition of a [w] glide plus schwa in words such as "call" and "caught." Wise,[190] however, stated that the most frequent Eastern substitution for the General American [ɔ] in words such as those listed above is the [ɑ], i.e. [dɑg] and [sɑft]. This same alteration was mentioned for Southern speakers in words such as "orange," [ɑrəndʒ] and "forest," [fɑrəst]. In terms of the back vowel [u], both Akin[191] and Wise[192] made reference to the practice of Southern speakers inserting a [j] to diphthongize this sound in words such as "tune," "doom" and "nude."

Hanley and Thurman provided both a summary of the above descriptions and some additional information relative to differentiating features of the dialects. They listed the following characteristics as the major differences between General American and Eastern Speech.[193]

---

[189] Akin, op. cit., p. 41.

[190] Wise, op. cit., p. 107.

[191] Akin, op. cit., p. 51.

[192] Wise, op. cit., pp. 109-110.

[193] Hanley and Thurman, op. cit., p. 95.

1. The "broad a" [a] is used, though not as extensively as some people believe; it appears especially before the "s," "lf," "gh," and "th" endings.
2. There is a tendency for [ɑ] to become [ɔ] in words with [w]; examples are "want" [wɔnt], "watch" [wɔtʃ], and "water," [wɔtɚ].
3. There is a tendency for [ɛ] to become [æ] in "air," "are," and "arry" words; examples are "chair" [ˈtʃæ], "care" [ˈkæ:], and "marry" [ˈmærɪ].
4. There is a tendency for [ɔ] to become [ɑ] in "og" words; examples are "log" [ˈlɑg] and "fog" [ˈfɑg].
5. Unstressed suffixes tend to contain [I]; examples are "salad" [ˈsælɪd], "roses" [ˈrozɪz], and "biggest [ˈbɪgɪst].
6. The [ɜ] is used in "ear," "er," and "ir" words; examples are "heard" [ˈhɜd] and "term" [ˈtɜm].
7. Although the dialect seems to be changing in this feature, preconsonantal and final "r's" are often silent; examples are "cart" [ˈkɑ:t] and "for" [ˈfɔ:].
8. The secondary stress in "ery," "ary," and "ory" words may be dropped; examples are "cemetary" [ˈsɛmətrɪ] and "stationary" [ˈsteʃənrɪ].

Hanley and Thurman[194] indicated that the first seven characteristics listed above for the Eastern dialect also

---

[194]Hanley and Thurman, op. cit., p. 96.

serve to differentiate the Southern dialect from General American speech. In addition, they felt that the following three characteristics should be considered in making this latter differentiation.

1. There is a tendency to use [ɚ] for the final "r," as in "core" [koɚ], and "fire" [faɪɚ].
2. The "drawl" or prolongation, diphthongization are considered substandard variations; examples are "pop" [pɑəp], "baby" [beɪəbɪ], and "bless" [blɛjəs].
3. The omission of the second half of a diphthong is also considered substandard; examples are "ice" [ɑs], "fine" [fɑn], and "oil" [ɔl].

As a general summary, it appears that Eastern and Southern speakers both drop or alter the [ɝ] and [ɚ] in the final position in words such as "far" and "poor," while General American speakers retain these sounds. In words such as "barn," "park," "form," and "third," with the vocalic "r" preceeding a final consonant, the same situation occurs. Consonant "r's," i.e., [r], appear to be handled the same across all three dialects.

The [ɔ] sound as it is used in the General American dialect in such words as "foreign" and "orange" is flattened or broadened to an [ɑ] in both Eastern and Southern speech. This broadening is followed through by Eastern speakers in such words as "hog" and "frog" while the Southern speaker tends most often to follow the General American use of [ɔ].

Eastern speakers also occasionally broaden the vowel as it is usually pronounced by General American speakers in such words as "ask" and "dance." Southern speakers use the same pronunciation of this vowel as do General American speakers.

An occasional characteristic of Southern speech is the insertion of the [j] to form a diphthong in words such as "duty" and "tune."

Despite the abundancy of research in terms of the differentiating characteristics of the three dialects of American English, no studies of listener performance in making these differentiations were encountered in the literature.

In summary, there is some evidence that listeners can, upon hearing speakers' voices, make differing degrees of valid judgments about them relative to their sex, age, and physical characteristics. In terms of sex, this success was attained in the 1930's by Pear.[195] With regard to age and physical characteristics, such differentiations have been very gross. No studies were encountered in the literature which dealt with listener identifications of ethnic group, education level, and dialect region. There is evidence, however, that differentiations within these characteristics should be able to be made from hearing speakers' voices.

---

[195] Pear, op. cit., 117.

Training

The term "training" as used in the present study is not synonomous with the term "learning." These two terms were contrasted by Wolfle.[196] He stated that if an investigator's primary interest is in the process by which knowledge is acquired, then his studies are classified under the heading of "learning"; if his primary interest is in the teaching of knowledge or skill, his work is classified under the heading of "training." The latter category was of main interest in the present study.

With specific regard to training, Wolfe has suggested the following guidelines for such programs:[197] (1) the distribution of practice should be suitable for the task to be learned; (2) active participation by the learner is superior to passive receptivity; (3) practive material should be varied so that the learner can adapt to realistic variation and so that motivation during drill is improved; (4) performance records should be kept in order to evaluate progress and the efforts of training; and (5) immediate knowledge should be given to the trainees regarding their performance.

---

[196]Doel Wolfle, "Training," Handbook of Experimental Psychology, ed. S. S. Stevens (New York: Wiley and Sons, 1951), pp. 1267-1268.

[197]Doel Wolfle, "Military Training and the Useful Parts of Learning Theory," Journal of Applied Psychology (1946), pp. 73-75.

In terms of training experiences, Kingsley[198] has stated that the smaller the interference between practice sessions, the more substantial the learning. In addition, he wrote that the shorter the practice period, the greater the learning that occurs. Mednick, however, did not support these points.[199] He indicated that spacing out training sessions only wastes time when the task to be learned is familiar. Under these conditions, a concentrated single program may have some advantages over a series of spaced sessions.

Postman and Egan also offer guidelines relative to training as it applies in the present study.[200] They felt that in general, the more distributed the practice trials, the better the learning. However, as with Mednick,[201] they indicated that this principle varied according to the task. These authors also reported that meaningful materials are better retained than nonsense items. In addition, they stated that subjects learn best by performing tasks with full awareness of the principles guiding successful performance.

---

[198]Howard L. Kingsley, The Nature and Conditions of Learning (Englewood Cliffs, N.J.: Prentice-Hall, 1957), pp. 237-257.

[199]Sarnoff A. Mednick, Learning (Englewood Cliffs, N. J.: Prentice-Hall, 1964), p. 87.

[200]Leo Postman and James P. Egan, Experimental Psychology (New York: Harper and Brothers, 1949), pp. 395-462.

[201]Hednick, loc. cit.

This brief review of the literature in the area of training suggests several principles that guided the formulation of the training procedures evaluated in the present investigation. First, care was extended to maintain motivation. Second, as the task involved was largely a familiar one, i.e., judging speakers by voice on familiar characteristics, spaced practice was avoided in favor of one concentrated session. Third, knowledge of performance was provided to the subjects frequently throughout the program. Fourth, variation in practice was supplied to the extent that was possible. Finally, fifth, the subjects were involved actively during most of the training program.

No references were located in the review of the literature relative to the use of trained listeners for identifying speaker characteristics. However, the performance of these kinds of judges on similar tasks may be of significance. In terms of test-retest reliability, for example, Bryan and Wilke[202] have found poor agreement between first and second evaluations of public speeches by untrained judges. These authors also found poor inter-judge agreement using small groups of these raters. They found, in terms of inter-judge agreement, that five judges yielded a correlation coefficient of + .66. Using ten and 20 untrained judges,

---

[202]Alec I. Bryan and Wlater H. Wilke, "A Technique for Rating Public Speeches," Journal of Consulting Psychology, V (March-April, 1941), pp. 80-90.

however, they obtained coefficients of + .83 and + .91, respectively. Knower, in a similar study with trained judges obtained correlations ranging from + .35 to + .46 using low numbers.[203] He estimated that from eight to 16 judges would be necessary to produce reliability coefficients of + .87 or better.

Eckert and Keys,[204] using students as untrained listeners and teachers as trained listeners found that the former tended to be strongly influenced by what the authors called the "halo" effect when evaluating different traits of speakers. The trained judges, on the other hand, were found to be more discriminating.

In terms of evaluating defective speech, Perrin found, using the method of paried comparisons, that trained and untrained judges did not differ significantly in their evaluation of the severity of articulation defect.[205] In addition, both groups showed a significant amount of agreement within their own groups with respect to these ratings. However, the correlation between the number of sounds the

---

[203]Franklin Knower, "A Study of Rank-Order Methods of Evaluating Performance in Speech Contests," Journal of Applied Psychology, XXIV (October, 1940), pp. 633-644.

[204]R. G. Eckert and N. Keys, "Public Speaking as a Clue to Personality Adjustment," Journal of Applied Psychology, XXIV (January, 1940), pp. 144-153.

[205]Elinor Horwitz Perrin, "The Rating of Defective Speech by Trained and Untrained Observers," Journal of Speech and Hearing Disorders, XIX (March, 1954, pp. 48-51.

speakers misarticulated and the rated severity of the particular speech problems was + .98 for the trained group and + .82 for the untrained. The difference between these figures was significant, and according to Perrin, indicated that despite the gross similarities in general severity within a group agreement, trained judges are more valid evaluators of speech problems.

The Stimulus

As indicated in the definition section of the previous chapter, there were three important considerations with respect to the stimuli given to the subjects, i.e., the aural cues. These were: (1) duration, five, ten and fifteen seconds; (2) spontaneous as opposed to prepared speech; and (3) normal as opposed to telephone speech. As is obvious by the studies reviewed above under the section devoted to previous research on the six speaker characteristics of interest in this study, these factors have not played an important role. Typically, the duration of these stimuli was not specified or was described as being of some "sufficient" length, such as 30 seconds. In terms of spontaneous as opposed to prepared speech, all but one of the studies reviewed used oral reading as the stimulus. Finally, with the exception of the Fay and Middleton studies involving the voice as transmitted over a public address system, all stimuli consisted of either voice delivered by a concealed speaker or

or by recordings under typical face-to-face acoustic conditions.

The following sections include descriptions of these departures in addition to research related to the considerations of stimulus duration, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech as they applied in the present investigation.

Duration

The duration of speech samples used as stimuli in speaker identification studies to this point have typically not been specified. Other authors have described their samples as being sufficient or as being some specific duration that they considered to be sufficient. Duration as a factor affecting the performance of listeners in this task has not been researched.

Two studies, however have been concerned with the effects of duration on listener performance in rating the severity of articulation defectiveness. Morrison[206] found no significant differences in the performances of her raters under three conditions of stimuli duration, five, ten, and fifteen seconds. In addition, she found that the preferences of her judges were evenly divided between the five and ten second samples. The judges were agreed that the fifteen

---

[206] Shelia Morrison, "The Severity of Articulation Defectiveness," Journal of Speech and Hearing Disorders, XX (December, 1955), pp. 347-351.

second samples were too long. The author also noted that while evaluating these latter durations, judges tended to make their responses before the end of the samples, thus not using the total duration as a basis for their evaluations.

In a similar study, Sherman and Morrison[207] found no significant difference in the performance of listeners in judging the severity of articulation problems under two different durations, five and ten seconds.

It was interesting to note that not one of the studies reviewed mentioned the possibility of duration error. This is perhaps understandable in studies in which the goal is to present just a sufficient stimuli. However, in studies such as Morrison's[208] and Sherman and Morrison's[209] in which specific stimulus duration is a factor of interest, error cannot be ignored.

It was expected that the performance of listeners on the task required in the present study would improve with increased duration. This expectation was based on the premise that longer duration would provide them with additional cues.

---

[207]Dorothy Sherman and Sheilla Morrison, "Reliability of the Individual Ratings of Severity of Defective Articulation," Journal of Speech and Hearing Disorders, XX (December, 1955), pp. 352-358.

[208]Morrison, loc. cit.

[209]Sherman and Morrison, loc. cit.

Spontaneous as Opposed to
Prepared Speech

As reported above, all of the studies reviewed used prepared speech as the stimuli with the exception of one. Fay and Middleton,[210] in one of their many investigations in the area of speaker identification, used spontaneous speech in testing the performance of listeners in judging whether speakers were lying or telling the truth. In this study, an announcer asked a question and indicated to the respondent if he was to tell the truth or lie. Answers to the questions, then, were not prepared. Results indicated that listeners were able to make the required judgment correctly more often than was expected by chance. This result becomes meaningless, however, from the standpoint of comparing performance under both conditions, spontaneous and prepared.

The expectations with regard to this factor of the aural cues was that listeners would perform more accurately under spontaneous than under prepared speech conditions. This prediction was based for the most part on the contention that spontaneous speech is personal and therefore more revealing about the speaker than is oral reading. This was expected to be especially true in the present study for two

---

[210]Fay and Middleton, "The Ability to Judge Truth-Telling, or Lying, from the Voice as Transmitted over a Public Address System," Journal of General Psychology, XXIV (January, 1941), pp. 211-215.

reasons. First, the speakers did not read material of their own composition, i.e., not only was their speech during the readings removed from them in the sense of not being spontaneous, it was also removed from the standpoint of the words they uttered not being their own. Secondly, the material they read, as has been described above, was defined as being neutral. That is, its content was selected for the purpose of controlling for interaction between individual speakers and the topic.

Normal as Opposed to Telephone Speech

The speech signal transmitted by a telephone has not before been used as a stimulus in speaker identification studies. There has been, however, considerable research done on telephone systems. This work has been summarized by Fletcher.[211] He indicated that the telephone conversational framework is built up by a comparitively small number of words in a great variety of patterns around the principal words which are nouns.[212] Fletcher also contrasted findings with regard to telephone conversations and common words used in written English.[213] He reported that the most striking difference between the two is the large number of active verbs that occur among the most commonly used words on the

---

[211] Fletcher, loc. cit.

[212] Fletcher, op. cit., p. 92.

[213] Fletcher, op. cit., p. 93.

telephone, e.g., "get," "see," "know." None of these kinds of words appeared among the 50 most commonly used written English words. In addition, among the common written words five times as many conjunctions are used as compared to telephone conversations. Another interesting feature between these uses of English is that in telephone conversations 14 out of the first 100 commonly used words are of more than one syllable. In written English there are ten. Fletcher also pointed out differences in word origin.[214] In the first 100 words, 11 on the telephone list are derived from Latin while this is true of only two words on the written list.

In terms of typical speech intensity levels over the telephone, Fletcher reported a range from 54 to 75 dB, SPL.[215] He indicated that the mean for this distribution was 68 dB, SPL.[216] This is compared with an intensity of 65 dB, SPL, that Hanley and Thurman reported as the typical conversational speech level at three feet from a speakers' lips.[217]

This chapter has surveyed the previous literature with regard to listener identifications of the six speaker characteristics of interest in the present investigation

---

[214]Fletcher, op. cit., p. 94.

[215]Fletcher, op. cit., p. 77.

[216]Fletcher, op. cit., p. 395.

[217]Hanley and Thurman, op. cit., p. 127.

from two standpoints: (1) actual performance of listeners and (2) demonstrated vocal features that might serve as a basis upon which they could make the differentiations. In addition, sections were devoted to listener training, stimulus duration, prepared as opposed to spontaneous speech stimuli and telephone as opposed to spontaneous speech stimuli and telephone as opposed to normal speech stimuli as these factors applied in the present investigation.

CHAPTER III

EXPERIMENTAL PROCEDURES

Subjects

The listener subjects participating in this study were 138 undergraduate students at Michigan State University who were enrolled in Speech 108, Voice and Articulation, during the Spring quarter, 1967. This group was comprised of six recitation sections which were randomly selected from a total of 12 sections. Each section had an enrollment of 30 students. However, due to absences during the test and/or re-test administrations, it was necessary to set the N for each recitation group at 23. Reductions were made by means of random procedures with listener subject numbers being drawn out of a box for groups that totaled more than 23 after the test and re-test conditions had been completed.

Of the six recitation sections selected as listener subjects, three were selected at random from the six sections of Voice and Articulation that met for two one and one-half hour sessions per week. These three groups of 23 listener subjects each, were designed as trained subjects. The remaining three recitation sections used as listener groups were selected from the six Voice and Articulation sections

which met for three one hour sessions per week. These three groups of 23 listener subjects each were designated as untrained subjects.

Apparatus

The following instruments were used for: (1) recording the original speech samples, the training program, and the instructions; (2) constructing and presenting the test stimuli to the listener subjects; and (3) various evaluational procedures performed to determine the adequacy and validity of portions of the constructed materials.

1. Magnetic recording tape (3M, Type 111)
2. Five tape recorders (two Ampex, Model 601; Ampex, Model 350-G; Magnecord, Model 1022; and Wollensak, Model T-1500)
3. Amplifier-mixer (Ampex, Model MX-35)
4. Three microphones (Electro-Voice, Model 654; Bruel and Kjaer, Type 4131 with cathode follower; and Bruel and Kjaer, Type 4132 with cathode follower)
5. Microphone power supply (Bruel and Kjaer, Type 2801)
6. Pure tone oscillator (Hewlett-Packard, Model 202-C)
7. Anechoic chamber (Bruel and Kjaer, Type 4212)
8. Frequency analyzer (Bruel and Kjaer, Type 2107)
9. Power level recorder (Bruel and Kjaer, Type 2305)
10. Amplifier-speaker (Ampex, Model 620)
11. Timer (Hunter, Model 100-C, Series D)
12. Electronic switch (Grason-Stadler, Model 829-E)

13. Sound treated room (Industrial Acoustics Corporation, Series 400)

14. Two telephones (Western Electric)

15. Pitch instrument (Pyramid Chromatic)

16. Earphones (Telephonics, Model TDH-39)

17. Telephone-microphone coupler

18. Sound level meter (Bruel and Kjaer, Type 2203 with Bruel and Kjaer microphone, Type 4131)

Procedures

The experimental procedures involved the following steps: (1) testing the telephone recording system; (2) recording the speakers; (3) constructing the master tapes which comprised the actual test stimuli; (4) recording and constructing the training program; (5) constructing the post-training practice test; (6) recording the instructions to the listener subjects; and (7) administering the tests. These steps are described in detail below.

Telephone Recording System

In recording test stimuli from the telephone, it was desired to simulate speech, as nearly as possible, in the way a listener hears it during a conventional telephone conversation. This desire eliminated the possibility of using any commercially available telephone recording instrument. Such instruments were found to take the signal from the telephone system at some point before the signal reached the listener's ear. In the present study, the entire

telephone system was utilized. This was made possible by the construction of a coupler that enabled the speech signal to be recorded from the telephone receiver in much the same way as the listener receives the signal. A drawing of the coupler and its dimensions are shown in Figure 1. In terms of construction, it was composed of two parts. The base was a standard telephone receiver cap that screws on to the receiver. The cap was attached to screws to a circular plastic piece with a hole drilled down through the center to accomodate a condenser microphone (B and K, Type 4132, with cathode follower). With its protective grid in place, the diaphram of the microphone, while using this device, rested 4 millimeters from the most depressed portion of the concave receiver cap.

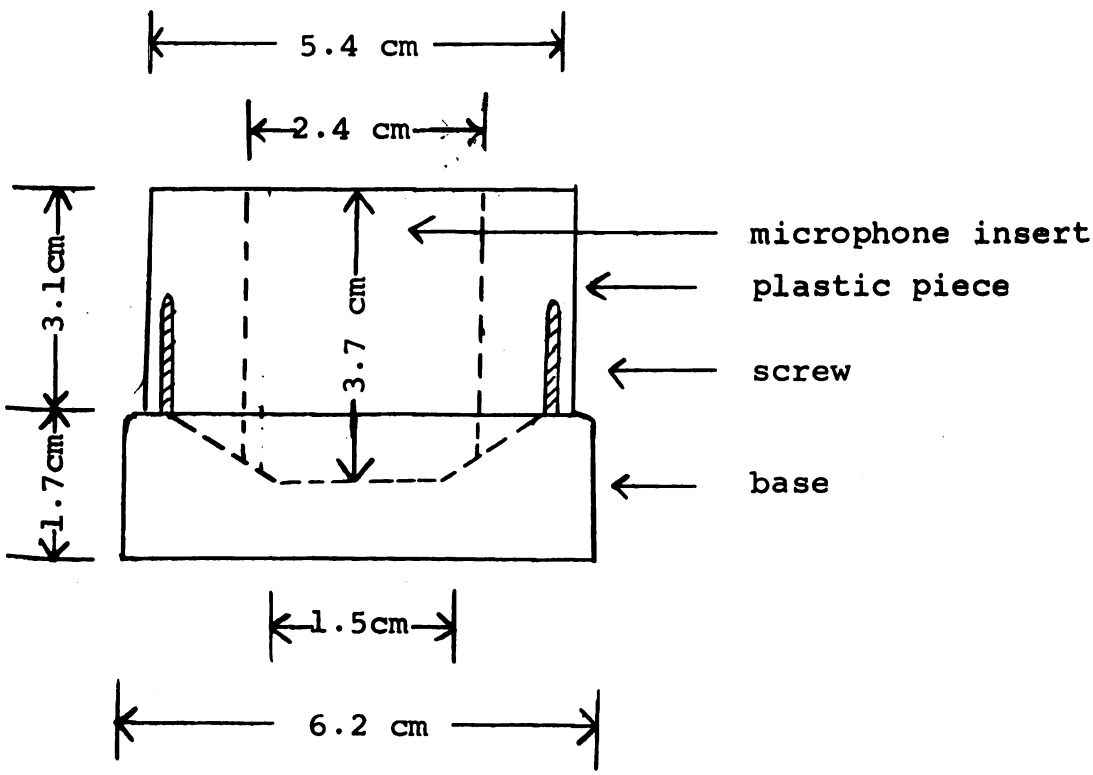

Figure 1.--Telephone-Microphone coupler.

The entire system was composed of the following: (1) sound treated room (IAC, Series 400); (2) input telephone (Western Electric, station number 61, Auditorium Building, Michigan State University); (3) output telephone with coupler (Western Electric, station number 60, Auditorium Building, Michigan State University); (4) condenser microphone (B and K, Type 4132, with protective grid and cathode follower and in conjunction with microphone power supply, B and K, Type 2801); (5) anechoic chamber (B and K, Type 4212); and (6) Tape recorder (Ampex, Model 601). A block diagram of the system is shown in Figure 2.

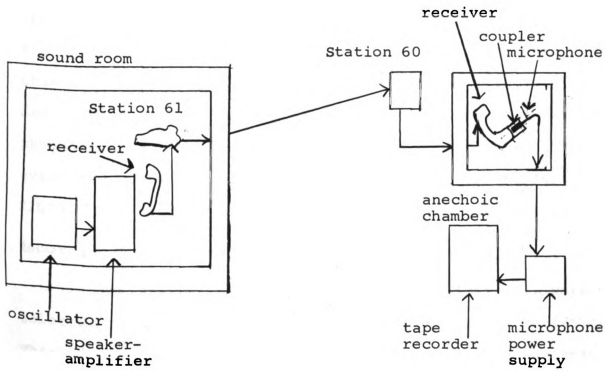

Figure 2.--Block diagram of telephone recording system.

The response of the telephone recording system was evaluated by means of recording pure tones from 125 to 10,000 Hz through it. An oscillator (H-P, Model 202-C) served as the sound source with its output channeled to an amplifier-speaker (Ampex, Model 620). The input telephone was attached to the speaker in such a way that its microphone portion rested directly in front of the center of the speaker at a distance of 1.5 centimeters. The output of the speaker was set at 75 dB, SPL (B and K SPL meter, Type 2203, with a B and K microphone, Type 4131, and standard grid) at a distance of 1.5 centimeters from the center of the speaker for each pure tone. The entire input portion of the system was located in the sound room referred to above. As indicated in Figure 2, the output telephone receiver was located in an anechoic chamber (B and K, Type 4212) and coupled to a microphone (B and K, Type 4132). The response characteristics of the telephone recording system as tested by this procedure were evaluated by means of a frequency analyzer (B and K, Type 2107). The results are graphically illustrated in Figure 3.

Recording of Speakers

The speakers, providing the stimulus material, were selected randomly for each of the six speaker characteristics. These procedures are described below for each characteristic. Six speakers for each dimension of the six characteristics were recorded for a total of 90. Specifically, these were as follows:

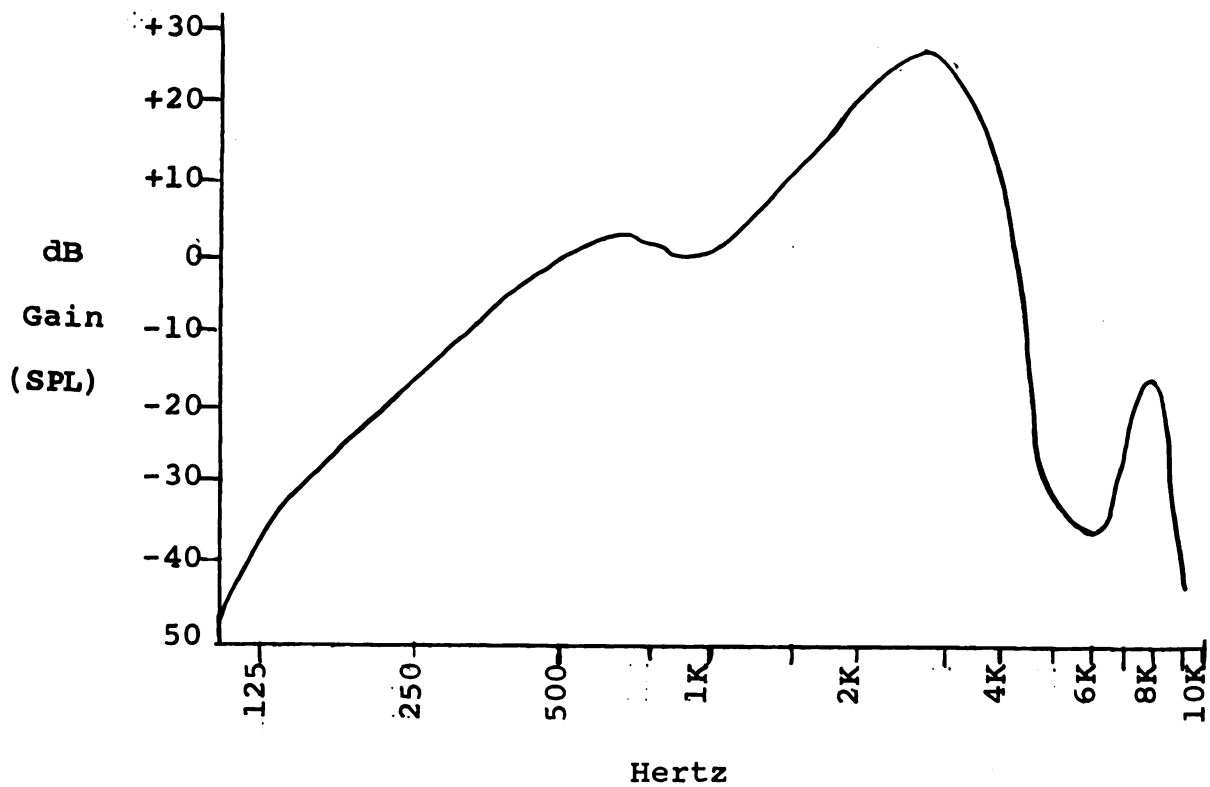

Figure 3.--Response characteristics of the telephone recording system.

Sex	12 speakers
Male	6 speakers
Female	6 speakers
Age	18 speakers
20-30	6 speakers
40-50	6 speakers
60-70	6 speakers
Ethnic Group	12 speakers
Negro	6 speakers
Caucasian	6 speakers
Education	18 speakers
Less than high school	6 speakers
High school graduate	6 speakers
College graduate	6 speakers

Physical Size.....12 speakers
Big..... 6 speakers
Small..... 6 speakers

Dialect Region.....18 speakers
Michigan..... 6 speakers
South..... 6 speakers
East..... 6 speakers

No speaker was used for more than one characteristic and, of course, within each characteristic, each speaker was eligible to be used under only one dimension. Speaker selection was made as follows.

Sex.--Twelve adult speakers, six males and six females, were selected randomly from volunteers from the Michigan State All-University Choir. The males were all tenors and were selected randomly from a population of ten volunteers. The females were all contraltos and were selected randomly from a population of 13 volunteers. All 12 speakers were from 18 to 25 years of age. They were all of the Caucasian ethnic group and spoke English as a native language. In addition, they were all natives of Michigan, i.e., they had been born, and attended elementary and secondary schools in this state.

Age.--Eighteen speakers, six between 20 and 30 years of age, six between 40 and 50 years of age, and six between 60 and 70 years of age, were selected randomly from the population of graduate students majoring in Speech and Hearing Science and the faculty members of the Department of Speech and other departments at Michigan State University. No one

was used as a speaker who was involved as an instructor with the population from which the listener subjects were drawn, i.e., the 12 recitation sections of Speech 108, Voice and Articulation. All 18 speakers were Caucasian males with English as their native tongue. The median ages for the three groups of six speakers was 26 years for the 20-30 year old group, 42 years for the 40-50 year old group, and 62 years for the 60-70 year old group.

Ethnic Group.--Twelve speakers, six of the Caucasian ethnic group and six of the Negro ethnic group, were randomly selected from the male population of students enrolled in Speech 101, Public Speaking, and Speech 108, Voice and Articulation, at Michigan State University during the Winter quarter, 1967. Specifically, the six Caucasian speakers were selected from a population of 407 and the six Negro speakers were selected from a population of 31. All 12 speakers were between 18 and 22 years of age and had been born and attended elementary and secondary schools in Michigan.

Education.--Eighteen adult speakers, three groups of six each, were selected as follows. Six speakers with less than a high school education were randomly selected from a population of ten such persons, all of whom were either successfully employed or in training for employment. Of the six selected as speakers in the study, two were employed as service station attendants, two as janitors, one as an

industrial maintenance man, and one as a warehouse worker. These speakers ranged from 19 to 32 years of age and had completed an median education level of grade ten. The six high school graduates were selected from a population of 13. These speakers were younger in age than the above group, ranging from 19 to 25 years. Two were employed as combination truck drivers-delivery men-salesmen, one as a delivery man for a dry cleaning establishment, one as a grocery store clerk, one as a service station attendant, and one worked for a florist, performing general greenhouse duties as well as selling duties. None of these six speakers had attended college. The six college graduate speakers were all employed as teachers and were randomly selected from a population of 11, all of whom were similarly employed. Age ranged from 23 to 29 years. In addition, all speakers representing this category were Caucasian males who spoke English as a native language and were natives of Michigan.

Physical Size.--Twelve speakers, six who qualified as "big" and six who qualified as "small," were chosen from the male students enrolled in Speech 101, Public Speaking, and Speech 108, Voice and Articulation, at Michigan State University during the Winter quarter, 1967, who met the specified size qualifications. As indicated in Chapter I, the terms "big" and "small" were defined relative to standard

norms for 17 to 19 year old males.[218] Thus, "big" speakers had a height equal to or larger than one standard deviation above the national mean for their age group (five feet, nine inches[219]) and had a weight equal to or larger than one standard deviation above the national mean for males in their age group who are one standard deviation above the national average in height (160 pounds[220]). With these criteria, "big" speakers had to be at least six feet tall and weigh 180 pounds. "Small" speakers were defined in the same manner using deviations below the national height and weight averages for their age group. That is, they were equal to or smaller than one standard deviation below the national mean for height[221] and had a weight equal to or smaller than one standard deviation below the national mean for males who are one standard deviation below the national average in height (137 pounds[222]). With these criteria, "small" speakers had to be less than or equal to five feet, six inches tall and weigh 121 pounds. The six "big" speakers were selected randomly from a population of 27 while the six "small"

---

[218]Society of Actuaries, Build and Blood Pressure Study, Vol. I (Chicago: Society of Actuaries, 1959).

[219]Ibid., p. 254.

[220]Ibid., p. 246.

[221]Ibid., p. 254.

[222]Ibid., p. 246.

speakers were chosen randomly from a population of 16. All speakers representing this characteristic were either 18 or 19 years of age. In addition, they were all Caucasian males who were natives of Michigan and spoke English as their native language.

Dialect Region.--Eighteen college freshman speakers, six who were born and attended elementary and secondary schools in Michigan (representing the General American dialect as defined by Wise[223]), six who were born and attended elementary and secondary school in either Georgia or South Carolina (representing the Southern dialect as defined by Wise[224]), and six who were born and attended elementary and secondary schools in eastern Massachusetts, i.e., east of the Connecticut River (representing the Eastern dialect as defined by Wise[225]), were selected randomly as follows. The speakers representing the General American dialect, those from Michigan, were chosen from a population of 266 freshman males who were enrolled in Speech 101, Public Speaking, at Michigan State University during Winter quarter, 1967. The speakers representing the Southern and Eastern dialects were selected from a population of 24 freshman males each which were provided by the Student Affairs Office, Division of Residence Hall Programs, at Michigan State University. As

---

[223] Wise, op. cit., p. 178.

[224] Ibid.

[225] Ibid.

indicated above, all speakers representing the Dialect Region characteristic were freshman males. In addition, all were Caucasian, either 18 or 19 years of age, and spoke English as their native language.

Each of these 90 speakers came to the Speech and Hearing Science Laboratory at Michigan State University to make their recordings. Four one-minute speech samples were recorded for each speaker, one under each of the following conditions: (1) an extemporaneous sample recorded directly from the microphone, i.e., spontaneous normal speech; (2) an extemporaneous sample recorded from the telephone as described in the section immediately above and illustrated in Figure 2, i.e., spontaneous telephone speech; (3) an oral reading sample recorded directly from the microphone, i.e., prepared normal speech; and (4) an oral reading sample recorded from the telephone as described in the section immediately above and illustrated in Figure 2, i.e., prepared telephone speech. For the two spontaneous samples, the speakers were asked to describe, in their own words, the content of two written "neutral" paragraphs. They were allowed to read through the written selections and then were given 30 seconds to plan their extemporaneous descriptions of the content. For the two prepared recordings, the speakers simply read similar paragraphs in a typical oral fashion.

The paragraphs used as speech stimuli are located in Appendix A. The "neutrality" used in describing these selections refers to their content. As can be seen in the appendix referred to above, these selections were factual in nature. It was assumed that there would be no interaction between this content and the various speaker characteristics that might provide the listeners with clues that would aid them in making the identifications requested.

For each of the 90 speakers, written paragraph selection and speech condition order for the four one-minute recordings were determined by random means. The total number of speech samples at four for each of the 90 speakers was 360.

All speech sample recordings were made with the speaker seated in a sound treated room (IAC, Series 400). The normal speech samples were recorded using a condenser microphone (B and K, Type 4131, with cathode follower and standard grid) in conjunction with a microphone power supply (B and K, Type 2801). The microphone was suspended by the speakers' neck by means of a lavaliere. In each case, the lavaliere was adjusted so that the protective grid of the microphone was approximately 20 centimeters below the speaker's lips. The telephone speech samples were recorded as described in Figure 2. The speaker, while again seated in the sound room, spoke into a telephone (Western Electric). The acoustic signal was then recorded from a second telephone

(Western Electric), the receiver of which had been placed in an anechoic chamber (B and K, Type 4212). As indicated in Figure 2, the microphone (B and K, Type 4132, with cathode follower and standard grid) was held in approximation to the receiver by a coupler (see Figure 1). The power supply to the microphone was as indicated above for the recordings under the normal speech condition. Identical tape recorders (Ampex, Model 601) were used in making the recordings during both speech sample conditions. The intensity levels of the recordings was adjusted so that the sepakers' voice peaked at zero on the recorders' VU meters. The same brand and series of magnetic tape was used in all recordings (3M, Type 111). Tape speed was seven and one-half inches per second.

The six males and six female speakers representing the sex characteristics were asked to participate in one additional process; that of determining their habitual and optimum pitches. This was accomplished by means of the procedures outlined by Fairbanks.[226] Optimum, or natural pitch for each speaker was calculated as 25 per cent of the way up his or her's total pitch range, including falsetto. Habitual pitch was calculated by having each speaker read the Rainbow Passage,[227] gradually compressing his or her pitch range as

---

[226]Grant Fairbanks, Voice and Articulation Drillbook (New York: Harper and Brothers, 1940), pp. 166-169.

[227]Ibid., p. 168.

the reading progressed. This latter process was repeated three times for each speaker with the most frequent result being considered as the habitual pitch. A pitch pipe (Pyramid Chromatic Pitch-Instrument) was used as a guideline during these procedures.

Construction of the Master Tapes

In preparation for constructing the master tapes, i.e., the actual test stimuli of the study, each group of six speakers for the various dimensions of the speaker characteristics were distributed randomly over three categories. Three of each group of six were selected to be used in the master tapes; two of each group of six were selected to be used in the training program; and one of each group of six was selected to be used in the practice test. For example, referring above to page 90, for the six speakers representing the male dimension of the sex characteristic, three were randomly selected to be used in the master tapes, i.e., providing the actual test stimuli for the listener subjects, while two were used in the training program and one in the practice test. This distribution was identical for each group of six speakers representing the various dimensions under all six characteristics. The total number of speakers employed on the master tapes, then, was 45. Since, as was indicated above each speaker had recorded four speech samples, the total number of speech samples included in the master tapes was 180.

In preparation for presenting the stimulus material for the identification of the listener subjects, three master tapes, each consisting of 60 excerpts of the original samples, were constructed. Each of these three master tapes contained speech sample excerpts of differing durations, e.g., Master Tape I contained 60 speech sample excerpts of five seconds each in duration; Master Tape II contained 60 speech sample excerpts of ten seconds each in duration; and Master Tape III contained 60 speech sample excerpts of 15 seconds each in duration. Each excerpt was selected randomly from the total speech sample with the only qualifying condition being that it begin and end during actual phonation. A ten second period of silence separated the excerpts on each tape.

As can be seen from the description immediately above, each of the three master tapes contained one-third of the total number of speech sample excerpts (180) used as actual test stimuli. The selection of excerpts to be used in any one master tape was again made by random means. However, this randomization was performed under the qualifications that the speech conditions and the dimensions of each of the speaker characteristics be equally represented across all three tapes. That is, each master tape contained two speech sample excerpts representing the Sex characteristic (one male and one female) under each combination of speech conditions, i.e., spontaneous normal speech; spontaneous telephone speech; prepared normal speech; and prepared

telephone speech--a total of eight speech sample excerpts, or a grand total across all three master tapes of 24 speech sample excerpts. It follows then, that across the three master tapes, the total number of speech sample excerpts under the Sex characteristic (three male and three female speakers with four speech samples each) was exhausted. The same was true for the remaining speaker characteristics. That is, for the remaining speaker characteristics for which there were two dimensions, e.g., Ethnic Group and Physical Size, there were eight excerpts on each tape or a total of 24 excerpts across all three tapes. Similarly, for the speaker characteristics for which there were three dimensions, e.g. Age, Education Level, and Dialect Region, there were 12 excerpts on each tape, or a total of 36 excerpts across all three tapes. The following outline of the make-up of the master tapes is set forth for the purpose of clarifying the above discussion. Each tape consisted of the following excerpts:

Spontaneous Speech Condition
- Normal Speech.....15 excerpts
  - Sex..... 2 (1 Male, 1 Female)
  - Age..... 3 (1 20-30, 1 40-50, 1 60-70)
  - Ethnic Group..... 2 (1 Negro 1 Caucasian)
  - Education..... 3 (1-H.S., 1 H.S., 1 College)
  - Physical Size..... 2 (1 Big, 1 Small)
  - Dialect Region.... 3 (1 Mich., 1 South, 1 East)

- Telephone Speech.....15 excerpts
  - Sex..... 2 (1 Male, 1 Female
  - Age..... 3 (1 20-30, 1 40-50, 1 60-70)
  - Ethnic Group..... 2 (1 Negro, 1 Caucasian)
  - Education..... 3 (1-H.S., 1 H.S., 1 College)
  - Physical Size..... 2 (1 Big, 1 Small)
  - Dialect Region.... 3 (1 Mich., 1 South, 1 East)

Prepared Speech Condition

Normal Speech.....15 excerpts
- Sex..... 2 (1 Male, 1 Female)
- Age..... 3 (1 20-30, 1 40-50 1 60-70)
- Ethnic Group..... 2 (1 Negro, 1 Caucasian)
- Education..... 3 (1-H.S., 1 H.S., 1 College)
- Physical Size..... 2 (1 Big, 1 Small)
- Dialect Region.... 3 (1 Mich., 1 South, 1 East)

Telephone Speech.....15 excerpts
- Sex..... 2 (1 Male, 1 Female)
- Age..... 3 (1 20-30, 1 40-50, 1 60-70)
- Ethnic Group..... 2 (1 Negro, 1 Caucasian
- Education..... 3 (1-H.S., 1 H.S., 1 College
- Physical Size..... 2 (1 Big, 1 Small)
- Dialect Region.... 3 (1 Mich., 1 South, 1 East)

TOTAL: 60 excerpts

Referring back to the randomization process within each tape, it will be recalled that each speech sample excerpt was taken at random from its one-minute speech sample. In addition, the master tape placement of a given excerpt within each combination of speech conditions and each dimension of the characteristics was done by random means. That is, for the Sex characteristic, there were a total of three spontaneous normal speech sample excerpts by male speakers. The randomization involved determining which of these three excerpts would be used in which master tape. Finally, after the 60 speech sample excerpts had been selected for each master tape, the order in which they were placed in the tapes was determined randomly.

The actual construction of the master tapes was done by re-recording. The process involved three steps for each speech sample excerpt placed on a master tape:

(1) introducing the excerpt by number, e.g., "Speaker one;" (2) selecting the excerpt of appropriate duration out of its one-minute speech sample and playing back on one recorder while recording on a second recorder; and (3) allowing for a ten second period of silence during which the listener subjects would indicate their judgment of the characteristic in question. The first step in this procedure was accomplished using a microphone (E-V, Model 654), mixer-amplifier (Ampex, Model MX-35) and the tape recorder that was used for recording the master tapes (Ampex, Model 350-G), hereafter referred to as recorder A. The experimenter served as the speaker for these introductions. The second step, re-recording an excerpt from its one-minute speech sample, involved a second tape recorder (Magnecord, Model 1022), hereafter referred to as recorder B, upon which the speech sample was played back, the mixer-amplifier (referred to above), and recorder A. The procedure employed was to determine the excerpt to be used from the particular one-minute sample, start recorder B, engage the "record" controls on recorder A at the appropriate point within the speech sample, and engage the "stop" control on the same recorder at the end of the particular duration being recorded. The third step merely involved allowing recorder A to advance tape for a period of ten seconds. During these procedures, the input to recorder A was monitored by means of earphones (telephonics, Model TDH-39). All recordings were made at seven and

one-half inches per second with peak input intensity set at zero on the VU meter of recorder A. A block diagram of this instrumentation is illustrated in Figure 4.

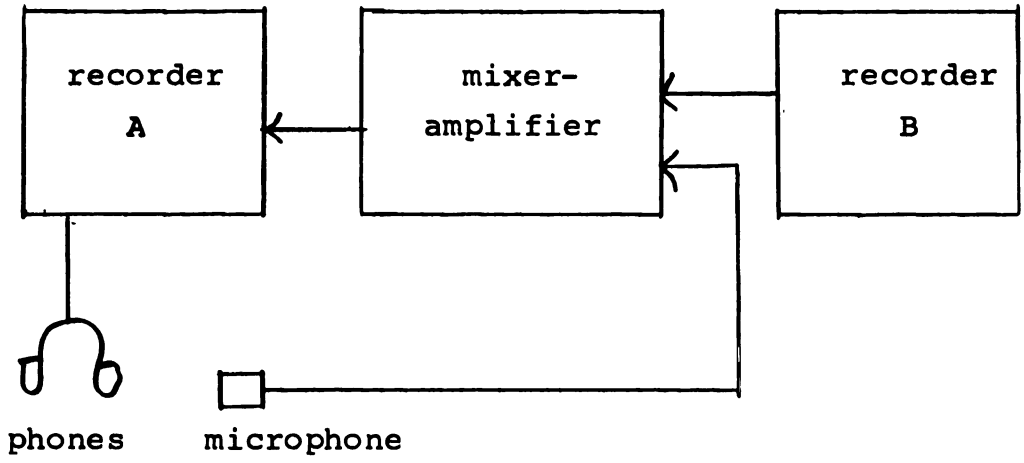

Figure 4.--Block diagram of instrumentation used in recording the master tapes.

Time durations for the five, ten, and 15 second samples were determined by means of a stop watch. It will be recalled that all speech sample excerpts recorded on the master tapes, regardless of duration, began and ended with phonation. Despite this, it was found, upon completion of the master tapes, that considerable time error was present for speech excerpt durations on Master Tapes I (five seconds) and II (ten seconds). Thus, several of these excerpts on each tape were re-recorded using a decade timer (Hunter, Model 100-C) in conjunction with an electronic switch (Grason-Stadler, Model 429-E) to control the actual duration of speech

placed on the master tapes. The procedure involved: (1) erasing the erroneous speech excerpt from the master tape; leaving the introduction, e.g., "Speaker one," and the ten second period of silence which had followed the excertp; and (2) recording the excerpt. This procedure, of necessity, either lengthened or shortened, by a portion of a second, the duration of the silent period that followed each erroneous speech sample excerpt. However, it was determined during preliminary testing that the ten second period of time that had been allowed for the listener subjects to make their evaluation for each excerpt was quite adequate. As a matter of fact, it was noted during both preliminary and actual testing that the listener subjects tended to mark their answer forms before the end of the particular excerpt in most cases.

Figures 5 and 6 are block diagrams of the instrumentation involved in correcting the erroneous excerpt durations and a schematic representation of the operation of the decade timer and electronic switch.

Following these corrections, the time error in excerpt duration for each of the three master tapes was as follows: (1) Master Tape I (five second excerpts) ranged from 4.95 to 5.05 seconds, i.e., one per cent maximum error; (2) Master tape II (ten second excerpts) ranged from 9.85 to 10.15 seconds, i.e., one and one-half per cent maximum error and (3) Master Tape III (15 second excerpts) ranged from

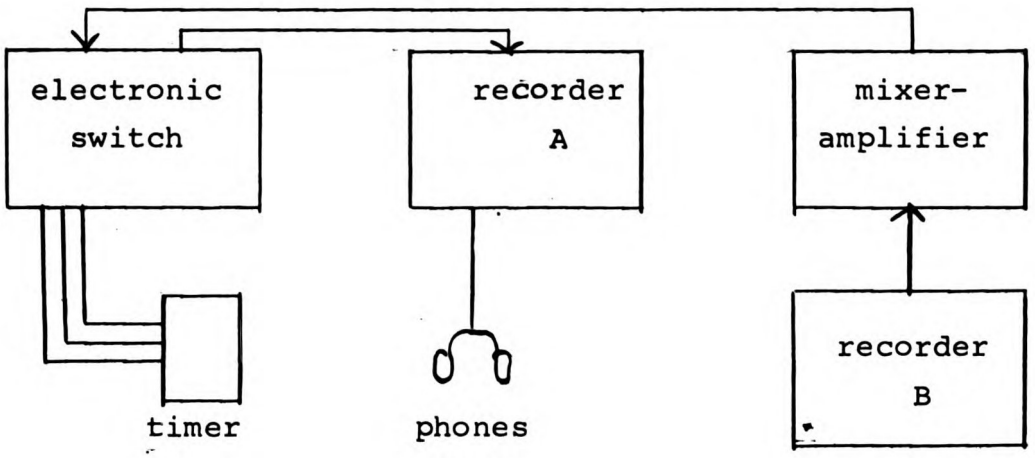

Figure 5.--Block diagram of the instrumentation used in correcting the erroneous speech sample excerpts.

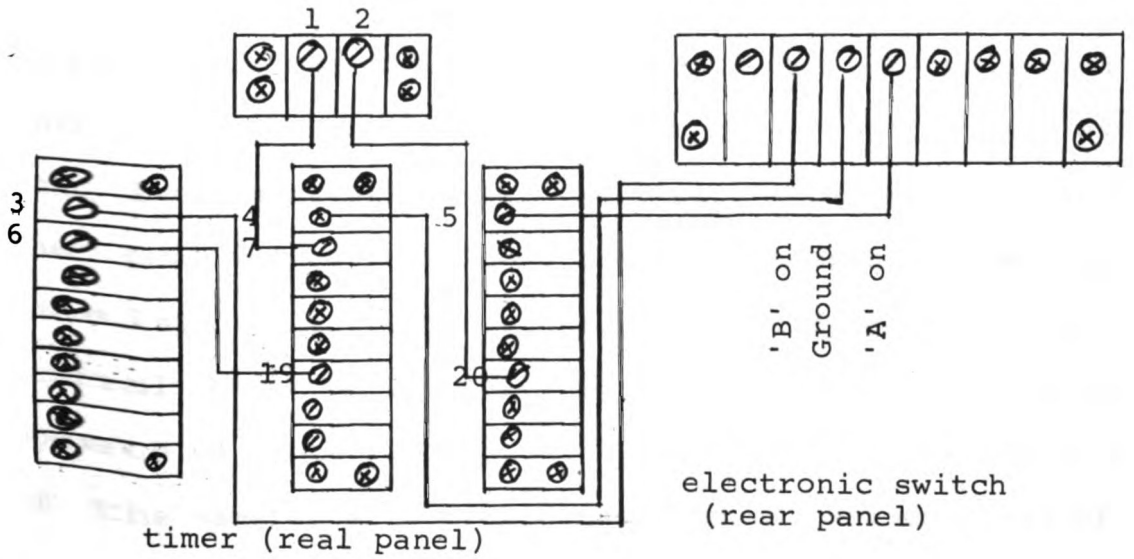

Figure 6.--Schematic representation of the operation of the timer and electronic switch

14.75 to 15.25 seconds, i.e., one and one-half per cent error. The specific durations of the speech sample excerpts on each master tape were determined by means of a power level recorder (B and K, Type 2305). The specific make-up of each is shown in Appendix B. The total time duration of each of the three master tapes was 16.5 minutes for Master Tape I (five second excerpts); 21.5 minutes for Master Tape II (ten second excerpts), and 26.5 minutes for Master Tape III (15 second excerpts).

Construction of the Training Program

The training program consisted of two parts: (1) presenting the listener subjects with information relative to differentiating between the various dimensions of each speaker characteristic; and (2) a practice test. In terms of the first part, the material presented was taken from information obtained in Chapter II. This was presented to the listener subjects in lecture form. Interspersed within the lecture material were practice speech sample excerpts. The practice test followed the lecture-practice material and consisted of 15 test items as they would appear during the actual test. On the training program all of the practice speech excerpts, including the practice test excerpts, were of the same duration for each group of trained listener subjects as the speech sample excerpts they would be hearing during their actual test conditions. Other than this

duration feature, the training program was identical for all trained groups.

The construction of the training program, the whole of which was presented to the listener subjects on magnetic tape (3M, Type 111), was similar to the construction of the master tapes. The experimenter served as the narrator or lecturer. The text of the program was recorded with the speaker seated in a sound room (IAC, Series 400). Instrumentation involved a microphone (E-V, Model 654), amplifier (Ampex, Model MX-35), and Tape recorder (Ampex, Model 350-G). A second individual controlled the instrumentation while the experimenter recorded the text. As with the other recordings, input was adjusted so that the recorder's VU meter read zero at peak intensity.

The program was originally recorded in sections. A re-recording was then made using the same procedure and instrumentation that was followed in the construction of the master tapes. That is, the text portions of the training program were re-recorded along with interspersed practice speech sample excerpts. These excerpts, it will be recalled, were taken from the original one-minute speech samples recorded by two of the six speakers representing each dimension of the various speaker characteristics. As indicated above, these speakers were selected at random from their original group just as the speakers used on the master tapes had been. The portion of the original one-minute speech sample used as

the practice excerpt was again determined randomly. In each case, the 15 second practice excerpts were recorded first. Successive recordings were then made of the ten and five second excerpts, using the same starting point, i.e., the beginning phonation of the 15 second excerpt at the appropriate point in terms of the duration desired. Duration was again determined by means of a stop watch. All practice speech excerpts were followed by a ten second period of silence just as the excerpts were on the master tapes.

A total of 66 practice excerpts were used in the training program. This number did not exhaust the total available for use (two speakers for each dimension of the speaker characteristics, total--30, at four samples for each speaker, total--120). Two factors were seen as important in determining how many and which speech samples to use in the program: (1) the amount of time available for the program and (2) the needs of the listener subjects in terms of training. As indicated above, time factors limited the number of practice excerpts to 66. The distribution of these excerpts across characteristics was then determined on the basis of expected listener subject needs. Thus, as indicated in the written text of the training program in Appendix C, there were the following number of practice excerpts for each speaker characteristic: (1) Sex, seven; (2) Age, 15; (3) Ethnic Group, ten; (4) Education, 13; (5) Physical Size, 12; and (6) Dialect Region, nine. In each case, the excerpts

chosen to be used as practice material were done so randomly within the needs of providing the listener subjects with practice under all conditions of speech and on each dimension of the various characteristics.

Post Training Practice Test

The practice test was identical in nature to the actual test, i.e., the master tape, for each group of trained listener subjects. Three versions of the test were constructed, the difference among them being the duration of the speech sample excerpts. As indicated above, this procedure was also followed in the body of the training program. That is, the trained group that received five second excerpts in their actual test situation also received five second excerpts as practice examples.

The construction of the practice tests, which were 15 items long, involved the same instrumentation and procedures as in the master tapes. Again, as with the practice excerpts in the body of the training program, the 15 second excerpts were re-recorded first with the ten and five second excerpts respectively, being taken from them.

In terms of speakers, it will be recalled that one of each group of six speakers recorded for each dimension of the various characteristics was selected for use in the practice test. That is, across the dimensions of the six characteristics, 15 speakers were used in this portion of

the training program. It will also be recalled that each of the 15 speakers had originally recorded four one-minute speech samples, one for each speech condition. Accordingly, for the 15 item practice test, one speech sample for each of these speakers was used in its construction. This selection was again done by random procedures. The make-up of the practice test appears in Appendix C along with the training program.

The total time duration of the complete training program was 50 minutes for the trained group that received 15 second practice speech sample excerpts and practice test excerpts. For the ten and five second groups, the sessions were 44.5 and 39.0 minutes respectively. The tape speed used in constructing all three versions of the training program was three and three quarters inches per second. This speed was used to enable the program to be placed on one continuous tape.

Recording the Instructions to Subjects

The instructions to the listener subjects were recorded using the same procedures and instrumentation as the text of the training program. The experimenter again acted as the speaker. Recordings were made from the sound room (IAC, Series 400) by means of a microphone (E-V, Model 654), amplifier (Ampex, Model MX-35), and tape recorder (Ampex,

Model 350-G). Recording speed was again three and three-quarters inches per second as for the training program.

The text of the instructions to listener subjects is contained in Appendix D. The total time duration of this recording was five minutes.

Testing the Subjects

As indicated above, there were six groups of 23 listener subjects each. Three of these six groups formed the trained sample. The remaining three formed the untrained sample. As will be recalled from the Subject section above, the listener subjects designated as trained were enrolled in Speech 108, Voice and Articulation recitation sections that met for two 90-minute sessions per week. This period of time allowed for presenting the training program and actual test at one setting for each of the groups. The untrained groups were formed by recitation sections that met for three 50-minute sessions per week.

Each group of trained and untrained listener subjects received different durations of speech sample excerpts, i.e., one trained and one untrained group received excerpts of five seconds duration, one trained and one untrained group received excerpts of ten seconds duration, and one trained and one untrained group received excerpts of 15 seconds duration. More specifically, Trained Group I and Untrained Group I were tested by Master Tape I; Trained Group II and Untrained Group

II by Master Tape II, and Trained Group III and Untrained Group III by Master Tape III. In addition, each of the trained groups received practice excerpts during their training period that were of the same duration as those on the master tape they received.

The stimulus material used with the trained groups was contained on two tapes. The first tape contained: (1) the training program and practice test (Appendix C) and (2) the instructions to the listener subjects (Appendix D). Instrumentation involved in this presentation was a tape recorder (Woolensak, Model T-1500). Total time duration, as indicated above, varied from 39 to 50 minutes according to speech excerpt duration. The second tape contained only the actual test, i.e., it consisted of one of the master tapes (Appendix B). Instrumentation for presenting this tape for each group was a second tape recorder (Ampex, Model 601) and an amplifier-speaker (Ampex, Model 620). Again, total time duration varied according to the duration of the speech sample excerpts presented. The total time duration for Trained Group I was 60.5 minutes (39 minutes for their training program and practice test, five minutes for the instructions, and 16.5 minutes for Master Tape I). The total time duration for Trained Group II was 71.0 minutes (44.5 minutes for their training program and practice test, five minutes for the instructions and 21.5 minutes for Master Tape II). The total time duration for Trained Group III was

81.5 minutes (50 minutes for their training program and practice test, five minutes for the instructions and 26.5 minutes for Master Tape III).

The stimulus material used with the untrained groups consisted of only the instructions from the first tape described above, and the appropriate master tape. Instrumentation was identical to that used with the trained groups. Total time durations were 21.5 minutes for Untrained Group I (five minutes for the instructions and 16.5 minutes for Master Tape I), 26.5 minutes for Untrained Group II (five minutes for the instructions and 21.5 minutes for Master Tape II), and 31.5 minutes for Untrained Group III (five minutes for the instructions and 26.5 minutes for Master Tape III). All tapes were presented at 75 dB, SPL, at the center of each classroom. This intensity level was determined by means of a calibrating tone recorded at zero, VU, on the beginning of each tape and a sound level meter (B and K, Type 2203).

Test session procedures involved the following steps: (1) setting up and calibrating the equipment before the listener subjects arrived in class; (2) distributing answer forms (Appendix E) to listener subjects as they entered the classroom; and (3) after all listener subjects had arrived, turning on the first tape (the appropriate training program and instructions for the trained groups, the instructions only for the untrained groups); (4) at the conclusion of the first tape, turning on the second tape (the appropriate

master tape); and (5) collecting the answer forms and dismissing the subjects.

As indicated in the discussions in the preceding sections of this chapter, the first tape played in the testing session (containing the training program and instructions) was recorded and played back at three and three-quarters inches per second. The master tapes were recorded and played back to listener subjects at seven and one-half inches per second.

The test procedures were repeated for each group exactly two days (48 hours) after the first administration. During this re-test, however, the trained groups did not receive the training program. During these procedures, all test administrations were the same, i.e., all six groups received only the instructions and the appropriate master tape. In the re-test situation, each group received the same master tape as they had during their test situation.

As indicated above, the answer forms used are contained in Appendix E. The entire test booklet as it is seen in this Appendix, i.e., the practice answer forms and the answer forms for the master tapes, was used for each of the trained groups under the test condition. However, these trained groups, under the re-test condition, were given only the final three pages of the booklet, pages eight, nine, and ten. As explained above, the training program was not re-administered under the re-test condition. The untrained

groups used only pages eight, nine, and ten in both their test and re-test administrations.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter presents the results obtained by the procedures described in Chapter III. Three trained and three untrained groups of 23 listener subjects each listened to five, ten, and fifteen second speech samples and made judgments relative to six characteristics of the speakers. These characteristics and the speech conditions under which listener subjects made their identifications are described in detail in the previous chapter.

Listener performance on this task was measured in terms of proportion of correct identifications. Of initial interest was the performance of the listener subjects in identifying correctly each of the speaker characteristics in general, i.e., across all combinations of training, speech, and duration conditions. The results of this aspect of the study were analyzed by means of single-sample Z tests for proportions. Test-retest reliability was also of interest with regard to the performance of listener subjects across all conditions.

Also of primary interest were the effects of listener training, spontaneous as opposed to prepared speech, normal

as opposed to telephone speech, and duration of the speech samples upon listener subject performance. These results were evaluated by means of the analysis of variance technique. The effects of these four factors were also of interest in terms of test-retest reliability.

Of final concern were the optimum and habitual pitch levels of the speakers used to furnish the stimuli by which the Sex characteristic was evaluated. This aspect of the results is presented below.

Results

Optimum and Habitual Pitch

As indicated by the review of the literature in Chapter II, the primary vocal characteristic serving to differentiate between male and female speakers is vocal pitch. Most authors agreed that the habitual pitch levels used by female speakers was approximately C_4 (256 Hz). For males a habitual pitch of about one octave lower on the musical scale was indicated. Based on these findings, it was felt that the speakers providing the stimuli by which the Sex characteristic would be evaluated should be selected from male and female samples that possibly would not be representative of their population in terms of vocal pitch. For this reason, these speakers were chosen from the tenor and contralto sections of the Michigan State University Choir.

Optimum and habitual pitch measures made on these speakers are presented in Table 2. The speakers designated by an asterisk were those used on the master tapes.

Table 2.--Optimum and habitual pitch measures made on speakers representing the Sex characteristic.

Speaker Number	Sex	Optimum Pitch	Habitual Pitch
1*	M	D_3	D_3
2*	M	$F\#_3$	G_3
3*	M	C_3	C_3
4	M	E_3	E_3
5	M	D_3	D_3
6	M	D_3	D_3
7*	F	A_4	A_4
8*	F	B_4	B_4
9*	F	$A\#_4$	A_4
10	F	C_4	C_4
11	F	A_4	A_4
12	F	$G\#_3$	G_3

As indicated in Table 2, the optimum and habitual pitch levels of the female speakers used to represent the Sex characteristic in the present study were somewhat lower than those cited in the literature. In the case of the

males, these measures were somewhat higher than the C_3 pitch level said to be used by most male speakers.

Single-Sample Z Tests

This portion of the analysis tested the obtained performance of listener subjects in making correct identifications of each characteristic across all training, speech, and duration conditions against their performance expected on the basis of chance. As direction was predicted, all tests were one-tailed in nature. The data used as the obtained measure consisted of the grand mean proportion correct over all listener subjects on each characteristic. These data are tabulated in Appendix F. The expected measures were computed for each characteristic on the basis of chance, i.e., the probability of a correct response, according to the number of alternatives for each characteristic. Specifically, for the Sex characteristic there were two alternatives--male and female. This was also true for the Ethnic Group (Caucasian and Negro) and Physical Size (big and small) characteristics. For these three characteristics, then, the mean proportion correct expected on the basis of chance was .50. Each of the remaining characteristics had three alternatives: Age--20 to 30 years, 40 to 50 years, and 60 to 70 years; Education--less than a high school graduate, a high school graduate and a college graduate; and Dialect Region--Michigan, the East, and the South. For these characteristics, then,

the mean proportion correct expected on the basis of chance was .33.

These data, the obtained grand mean proportion correct and the expected grand mean proportion correct, were subjected to six single-sample Z tests as outlined by Blalock.[228] The obtained Z scores along with the respective means for each characteristic are presented in Table 3.

Table 3.--Obtained and expected grand mean proportion correct and results of single-sample Z tests for each characteristic.

Characteristic	Obtained Proportion Correct	Expected Proportion Correct	Z*
Sex	.990	.500	11.67#
Age	.674	.333	8.60#
Ethnic Group	.637	.500	3.26#
Education	.549	.333	5.48#
Physical Size	.750	.500	5.95#
Dialect Region	.672	.333	8.55#

*$Z \geq 1.65$ required for significance at .05, one-tailed.

#Significant beyond the .05 level.

[228]Hubert M. Blalock, Social Statistics (New York: McGraw-Hill Book Company, 1960), pp. 149-152.

These procedures were used in testing the following null hypothesis:

1. The proportion of correct identifications of each of the speaker characteristics in question made on the basis of aural cues alone will not be significantly greater than what could be expected by chance.

Inspection of Table 3 indicates that all Z scores were highly significant. These results allow for rejection of the null hypothesis.

As described in Chapter III, test procedures were repeated for all listener subjects two days after their original test. These retest data are also presented in Appendix F. The grand mean proportion correct for each characteristic obtained during the retest procedures is presented in Table 4 along with test-retest correlation coefficients.

Table 4.--Grand mean proportion correct on the retest and Product-Moment Correlations for test-retest performance for each characteristic.

Characteristic	Grand Mean Proportion Correct	Correlation Coefficient
Sex	.991	.27
Age	.667	.66
Ethnic Group	.639	.71
Education	.544	.42
Physical Size	.729	.53
Dialect Region	.684	.45

Table 4 shows that the highest test-retest correlation was obtained for the Ethnic Group characteristic while the lowest was obtained for the Sex characteristic. However, despite the close agreement between test and retest means, none of the correlations approached what should be considered desirable in terms of explaining the variances between the test and retest situations.

Analyses of Variance

The balance of the null hypotheses derived from the questions stated in Chapter I were tested by means of six three-factor analyses of variance for repeated measures and one four-factor analysis of variance for repeated measures. Specifically, the procedures outlined by Winer[229] with reference to Case I in terms of the three-factor design and his extension of these principles to the four-factor model were followed.

As one of the primary interests in this study were the comparisons between and among trained and untrained listeners, spontaneous as opposed to prepared speech samples, normal as opposed to telephone speech samples, and speech samples that were five, ten and fifteen seconds in duration, the analysis of variance technique was felt to be the most appropriate form of analysis. The first three factors above, i.e., training and the two types of speech sample conditions,

---

[229]B. J. Winer, Statistical Principles in Experimental Design (New York: McGraw-Hill Book Company, 1962), pp. 319-336.

were the independent variables for the six three-factor analyses, one analysis for each speaker characteristic. The dependent variable in these analyses was again proportion correct for each listener subject. These data are presented in Appendix G.

In terms of these six three-factor analyses, it was felt that the necessary assumptions as specified by Winer[230] were met. That is, it was assumed (1) that each listener subject population (trained and untrained) was normally distributed with regard to the observations in question and (2) that each of these populations had variances which were equal over these observations. It was also assumed (3) that all observations across listener subjects were independent, i.e., observations made by each subject were independent of those made by each other subject within treatments and across treatments (trained and untrained). However, the same assumption could not be made across the remaining two factors. That is, the same listener subjects made identifications under both the spontaneous as opposed to prepared speech conditions and the normal as opposed to telephone speech conditions. Observations under the two training conditions were independent as separate groups of listener subjects were used as trained and untrained judges. It was for this reason that the factor analysis for repeated measures (repeated

---

[230] Ibid.

measures on two of three possible factors) was utilized in the six three-way analyses.

In addition to the assumptions specified above, Winer[231] listed two additional assumptions that are necessary with specific regard to employing the repeated measures design. These were: (1) that the order in which treatments, i.e., those upon which repeated measures are made, are administered to listener subjects be randomized independently for each of the subjects and (2) that the n elements in a group (listener subjects) be a random sample from a specified population. It is felt that the first assumption was met in the present study on two levels. First, although the order in which treatments were administered was not randomly determined for each listener subject, it was randomly determined for each group of listener subjects, the make-up of which was considered to be a random sample as specified in assumption number two above. Secondly, the treatments in question, spontaneous as opposed to prepared speech and normal as opposed to telephone speech (those for which repeated measures were taken) were not administered as a whole at any one given time. As indicated in Chapter III, random means were used to determine the speech sample order on all three master tapes. Therefore, each master tape had on it an equal number of speech samples recorded under conditions of

---

[231] Ibid.

spontaneous normal speech, spontaneous telephone speech, prepared normal speech, and prepared telephone speech, each of which was placed randomly on a given tape.

As indicated above, it was necessary to assume for the present design that error variance among the treatment populations in each of the six analyses was the same, i.e., no statistically significant differences existed among these error variances. Hays[232] stated that, other things being equal, this assumption of homogeneous variances can be violated without serious risk, provided that the number of cases in each sample is the same. Winer[233] also indicated that moderate departures from this assumption do not seriously affect the sampling distribution of the F statistic. Furthermore, Hays[234] stated that a test for homogeneity of variance before the analysis of variance has rather limited practical utility and modern opinion holds that the analysis of variance can and should be carried out without a preliminary test of variances, especially in situations where the number of cases in the various samples are equal. For these reasons and the fact that there were equal numbers of listener subjects in each of the present treatment groups, homogeneity of variance was assumed in all analyses.

---

[232]William L. Hays, Statistics for Psychologists (New York: Holt, Rinehart, and Winston, 1963), pp. 378-379.

[233]Winer, op. cit., p. 92.

[234]Hays, op. cit., p. 381.

The results of each of the following three-factor analyses (2 X 2 X 2), one for each speaker characteristic, are presented in the following sequence: (1) the mean proportion correct under each of the three main factors; (2) the analysis of variance summary table; and (3) difference of means. The latter segment under each characteristic includes graphic representations of the means and difference of means tests performed on interactions for which a significant over-all F was obtained. Such tests were not necessary for the main effects as each factor contained only two treatments. Difference of means tests performed on over-all significant interactions followed the Newman-Keuls procedures as outlined by Winer.[235] The results of these individual comparisons are summarized schematically using the following symbols to represent the combinations of treatment means:

Tr - trained listeners
Un - untrained listeners

Sp - spontaneous speech
Pr - prepared speech

No - normal speech
Te - telephone speech

Treatments underlined by a common line do not differ from each other significantly; treatments not underlined by a common line do differ from each other. As in the analysis of variance procedures, a significance level of .05 is used

---

[235]Winer, op. cit., pp. 80, 309.

throughout in reporting the individual comparisons. An example of this method of reporting is as follows:

1 2 3 4 5

In this case, treatment five differs from treatments one and two but not from three and four. All treatment means will be ordered left to right from lowest to the highest.

In addition to the above three items, each analysis is followed by presentation and discussion of the effects of training and the two speech conditions on test-retest reliability for the particular speaker characteristic in question (Appendix G).

Sex.--The first 2 X 2 X 2 analysis of variance for repeated measures was performed to ascertain the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener subject identification of the Sex characteristic. The mean proportion correct obtained under each treatment of the three factors and their differences and standard deviations are presented in Table 5.

The summary table of the analysis of variance is presented in Table 6. Inspection of Table 6 shows that none of the obtained F statistics are significant. However, the F for the interaction of all three factors approaches significance at .07. Inspection of the means of the main effects

in Table 5 indicates that, even though significant differences were not obtained, the trained listener subjects performed slightly better than did the untrained listeners in identifying correctly male and female speakers. In addition, the standard deviation of the judges' ratings was lower than the untrained group. Additional observations from Table 5 indicate that the listener subjects performed better under the spontaneous and normal speech conditions than they did under the prepared and telephone conditions. Also, these higher levels of performance were accompanied by lower standard deviations in each case.

Table 5.--Mean proportion correct and standard deviation for each treatment and difference between the treatment means of the three main factors for the Sex characteristic.

Treatment	Mean	Difference	Standard Deviation
Untrained subjects	.98551	.00906	.08403
Trained subjects	.99457		.05193
Spontaneous speech	.99457	.00906	.05193
Prepared speech	.98551		.08403
Normal speech	.99094	.00181	.06681
Telephone speech	.98913		.07304
TOTALS	.99004		.06994

Table 6.--Summary of analysis of variance comparing the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener performance for the Sex characteristic.

Source of Variation	df	Mean Square	F*
Between subjects	137		
Training (A)	1	0.0113	1.77
Ss within groups	136		
Within subjects	414		
Spontaneous-Prepared (B)	1	0.0113	2.28
A X B	1	0.0004	0.09
B X Ss within groups	136	0.0049	
Normal-Telephone (C)	1	0.0004	0.09
A X C	1	0.0041	0.81
C X Ss within groups	136	0.0050	
B X C	1	0.0040	1.31
A X B X C	1	0.0113	3.65
B X C X Ss within groups	136	0.0031	

*$F \geq 3.84$ required for significance at the .05 level, with 1, 1.36 df.

The produce-moment correlation coefficients for test-retest reliability under each of the main effects for Sex are presented in Table 7.

The coefficients shown in this table again illustrate the poor test-retest reliability obtained for the task in question.

Table 7.--Product-moment correlation coefficients for test-retest reliability on the Sex characteristic for trained and untrained subjects, spontaneous and prepared speech samples, and normal and telephone speech samples.

Treatment	Correlation Coefficient
Untrained subjects	.42
Trained subjects	-.01
Spontaneous speech	.46
Prepared speech	.15
Normal speech	.43
Telephone speech	.14

Age.--The second 2 X 2 X 2 analysis of variance for repeated measures was performed to ascertain the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener subject identifications of the Age characteristic. The mean proportion correct under each treatment of the three factors and their differences and standard deviations are presented in Table 8.

The summary table for the analysis of variance is presented in Table 9.

Inspection of Table 9 shows that significant F statistics were obtained for the spontaneous as opposed to prepared speech condition and for the normal as opposed to telephone speech condition. The means for these treatments shown in Table 8 indicate that the listener subjects performed

better in identifying the Age characteristic under the condition of spontaneous speech than they did under the condition of prepared speech. The significant F in terms of the normal-telephone factor is due to the listener subjects performing better under the condition of telephone speech than they did under the condition of normal speech. Interestingly enough, the standard deviations obtained under the spontaneous and prepared speech conditions were higher for the treatment under which the better performance was obtained. As indicated in Table 8, the reverse was true under the normal as opposed to telephone speech condition.

Table 8.--Mean proportion correct and standard deviation for each treatment and difference between the treatment means of the three main factors for the Age characteristic.

Treatment	Mean	Difference	Standard Deviation
Untrained subjects	.65638	.03425	.28005
Trained subjects	.69163		.26633
Spontaneous speech	.73366	.11931	.29726
Prepared speech	.61435		.23340
Normal speech	.63942	.06917	.27755
Telephone speech	.70859		.26561
TOTALS	.67400		.27360

Table 9.--Summary of analysis of variance comparing the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener performance for the Age characteristic.

Source of Variation	df	Mean Square	F*
Between subjects	137		
Training (A)	1	0.1715	2.33
Ss within groups	136	0.0737	
Within subjects	414		
Spontaneous-Prepared (B)	1	1.9645	17.94#
A X B	1	0.1044	0.95
B X Ss within groups	136	0.1095	
Normal-Telephone (C)	1	0.6602	12.24#
A X C	1	0.1049	1.94
C X Ss within groups	136	0.0540	
B X C	1	0.0721	1.67
A X B X C	1	0.0477	1.11
B X C X Ss within groups	136	0.0431	

*$F \geq 3.84$ required for significance at the .05 level, with 1, 136 df.

#Significant beyond the .05 level.

The product-moment correlation coefficients for test-retest reliability of each treatment under the main effects for age are presented in Table 10.

Inspection of Table 10 indicates that, as with the Sex characteristic, exposure to the training program did not seem to benefit listener subject performance in terms of test-retest reliability. This table also indicates that the

listener subjects were more reliable on the two tests under the conditions of spontaneous and normal speech than they were under the conditions of prepared and telephone speech.

Table 10.--Product-moment correlation coefficients for test-retest reliability on the Age characteristic for trained and untrained subjects, spontaneous and prepared speech samples, and normal and telephone speech samples.

Treatment	Correlation Coefficient
Untrained subjects	.66
Trained subjects	.66
Spontaneous speech	.72
Prepared speech	.51
Normal speech	.67
Telephone speech	.63

Ethnic Group.--The third 2 X 2 X 2 analysis of variance for repeated measures tested the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener subject identifications of the Ethnic Group characteristic. The mean proportion correct under each treatment of the three factors and their differences and standard deviations are presented in Table 11.

The summary table for the analysis of variance is presented in Table 12. The analysis of variance for the

Ethnic Group characteristic shows two significant F statistics. One is for the main effect spontaneous as opposed to prepared speech. Inspection of the two means for this factor in Table 11 indicates that the listener subjects had a higher mean proportion correct on the Ethnic Group characteristic under the condition of prepared speech samples. The remaining significant F was obtained for the spontaneous-prepared speech by normal-telephone speech interaction. The individual treatment combination means for this interaction are represented graphically in Figure 7.

Table 11.--Mean proportion correct and standard deviation for each treatment and differences between the treatment means of the three main factors for the Ethnic Group characteristic.

Treatment	Mean	Difference	Standard Deviation
Untrained subjects	.63768	.00000	.37304
Trained subjects	.63768		.33720
Spontaneous speech	.58696	.10144	.41082
Prepared speech	.68840		.28092
Normal speech	.62681	.02204	.35194
Telephone speech	.64855		.35883
TOTALS	.63768		.35524

Table 12.--Summary of analysis of variance comparing the effects of listener training, spontaneous as opposed to telephone speech on listener performance for the Ethnic Group characteristic.

Source of Variation	df	Mean Square	F*
Between subjects	137		
Training (A)	1	0.0000	0.00
Ss within groups	136	0.1667	
Within subjects	414		
Spontaneous-Prepared (B)	1	1.4203	10.04#
A X B	1	0.4638	3.29
B X Ss within groups	136	0.1415	
Normal-Telephone (C)	1	0.0652	0.63
A X C	1	0.0290	0.28
C X Ss within groups	136	0.1032	
B X C	1	2.3478	35.10#
A X B X C	1	0.1812	2.71
B X C X Ss within groups	136	0.0669	

*$F \geq 3.84$ required for significance at the .05 level, with 1, 136 df.

#Significant beyond the .05 level.

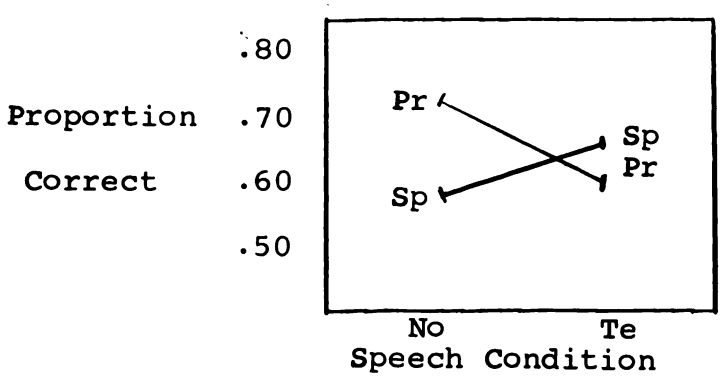

Figure 7.--Graphic representation of the individual treatment combination means for the spontaneous-prepared and normal-telephone interaction on the Ethnic Group characteristic.

In order to determine the origin of this significance, a test on the individual means using the Newman-Keuls procedure was used as described above. The following results were obtained:

SpNo PrTe SpTe PrNo

It will be recalled that under this method of reporting, treatment means underlined by a common line do not differ from each other. In terms of the results reported above, it can be seen that the mean proportion correct obtained under the prepared normal treatment combination was significantly greater than on any of the other three treatment combinations. In addition, the results indicate that while the two combinations of telephone speech (SpTe and PrTe) do not differ from each other, the two combinations of normal speech (SpNo and PrNo) do. That is, within the telephone speech treatment combinations, the mean proportion correct obtained under spontaneous speech and prepared speech did not differ while within the normal treatment combinations, the listener subjects were able to identify a significantly larger proportion of the Ethnic Group speech samples under the prepared condition than they were under the spontaneous condition. Also, within the prepared speech treatment combinations, a significantly higher mean was obtained under the normal speech condition than under the telephone speech condition. Within the spontaneous treatment combinations, this pattern was reversed. The listener subjects correctly

identified a significantly higher proportion correct under the telephone condition than they did under the normal condition.

The product-moment correlation coefficients for test-retest reliability for each treatment under the three main effects for the Ethnic Group characteristic are presented in Table 13. This table indicates that, under the Ethnic Group characteristic, the trained listener subjects were slightly more reliable in terms of test-retest correlation than the untrained listener subjects. In addition, it can be seen from the table that the listener subjects were more reliable in their performance on this characteristic under the spontaneous and telephone speech conditions than under the prepared and normal speech conditions.

Table 13.--Product-moment correlation coefficients for test-retest reliability on the Ethnic Group characteristic for trained and untrained subjects, spontaneous and prepared speech samples, and normal and telephone speech samples.

Treatment	Correlation Coefficient
Untrained subjects	.67
Trained subjects	.76
Spontaneous speech	.79
Prepared speech	.52
Normal speech	.58
Telephone speech	.82

Education.--The fourth 2 X 2 X 2 analysis of variance for repeated measures was performed to test the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener subject identifications of the Education characteristic. The mean proportion correct under each treatment of the three main factors and their differences and standard deviations are presented in Table 14.

Table 14.--Mean proportion correct and standard deviation for each treatment and difference between the treatment means of the three main factors for the Education characteristic.

Treatment	Mean	Difference	Standard Deviation
Untrained subjects	.52916	.04012	.28918
Trained subjects	.56928		.28649
Spontaneous speech	.52649	.04547	.29221
Prepared speech	.57916		.28230
Normal speech	.55221	.00598	.27149
Telephone speech	.54623		.30461
TOTALS	.54922		.28828

The summary table for the analysis of variance is presented in Table 15. Inspection of this table indicates only one significant F. This statistic was obtained for the B X C interaction effect (spontaneous-prepared by normal-telephone speech sample conditions) indicating that this

combination of treatments has some significant effect upon the performance of the listener subjects in identifying the Education characteristic. It will be recalled that this same interaction effect was significant for the Ethnic Group characteristic. The individual treatment combination means for this interaction are represented graphically in Figure 8.

Table 15.--Summary of analysis of variances comparing the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener performance for the Education characteristic.

Source of Variation	df	Mean Square	F*
Between subjects	137		
Training (A)	1	0.2220	2.65
Ss within groups	136	0.0839	
Within subjects	414		
Spontaneous-Prepared (B)	1	0.2853	3.40
A X B	1	0.0111	0.13
B X Ss within groups	136	0.0839	
Normal-Telephone (C)	1	0.0049	0.06
A X C	1	0.0053	0.07
C X Ss within groups	136	0.0777	
B X C	1	1.9100	26.56#
A X B X C	1	0.1926	2.68
B X C X Ss within groups	136	0.0719	

*$F \geq 3.84$ required for significance at the .05 level, with 1, 136 df.

#Significant beyond the .05 level.

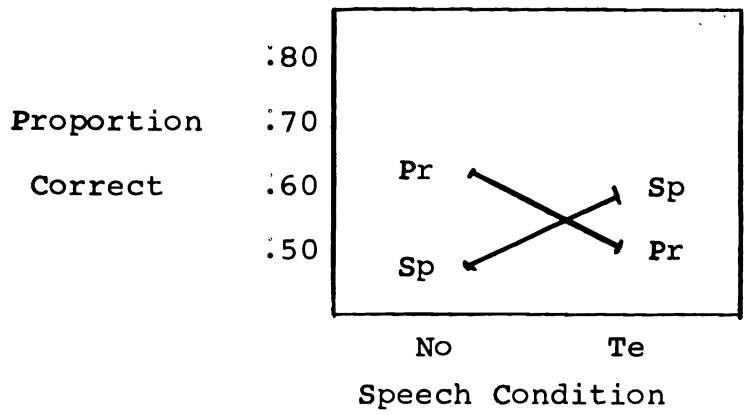

Figure 8.--Graphic representation of the individual treatment combination means for the spontaneous-prepared and normal-telephone interaction on the Education characteristic.

A difference of means test was performed as before with the following results:

SpNo PrTe SpTe PrNo

It can be seen from these results that while the order of mean size is the same as was the case for this significant interaction effect under the Ethnic Group characteristic, the differences between means are not of the same variety. In this case, listener subject performance under the prepared normal treatment combination was again significantly higher than any of the other three treatment combinations. However, the relationship between the two combinations of telephone speech samples (SpTe and PrTe) is different. Under the Ethnic Group characteristic, the means for these two treatment combinations were not significantly different from each other. For the present interaction,

however, they are. In addition, under the Ethnic Group characteristic, both of the telephone speech treatment combination means were significantly larger than the mean for the spontaneous normal treatment combination. For the Education group, however, only the spontaneous telephone combination mean was larger.

It can also be noted that within the normal speech treatment combinations a significantly higher mean proportion correct was obtained for the Education characteristic under the prepared speech condition than under the spontaneous speech condition. In addition, within the prepared speech treatment combinations, significantly higher means were obtained for prepared normal speech than for prepared telephone speech. Within the spontaneous treatment combination, this order was reversed. Significantly higher means were obtained under conditions of telephone speech than under conditions of normal speech. In reality, it can be seen that all possible meaningful treatment combinations composing this interaction effect were significantly different from each other. The only two means underlined by a common line are those for the spontaneous normal treatment combination and the prepared telephone combination.

The product-moment correlation coefficients for test-retest reliability for each treatment under the three main effects for Education are presented in Table 16.

Table 16.--Product-moment correlation coefficients for test-retest reliability on the Education characteristic for trained and untrained subjects, spontaneous and prepared speech samples, and normal and telephone speech samples.

Treatment	Correlation Coefficient
Untreated subjects	.43
Trained subjects	.41
Spontaneous speech	.47
Prepared speech	.37
Normal speech	.37
Telephone speech	.46

Inspection of the coefficients in Table 16 indicates that again, training did not appear to have an effect upon test-retest reliability. This table also indicates that test-retest reliability was slightly higher under the spontaneous and telephone speech conditions than under the prepared and normal speech conditions. None of the coefficients approach acceptability in terms of explained variance.

Physical Size.--The fifth 2 X 2 X 2 analysis of variance for repeated measures was performed to test the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener subject identifications of the Physical Size characteristic. The mean proportion correct under each treatment of the three

main factors and their differences and standard deviations are presented in Table 17.

Table 17.--Mean proportion correct and standard deviation for each treatment and difference between the treatment of the three main factors for the Physical Size characteristic.

Treatment	Mean	Difference	Standard Deviation
Untrained subjects	.73370	:03260	.32850
Trained subjects	.76630		.27750
Spontaneous speech	.70109	.09782	.32243
Prepared speech	.79891		.27693
Normal speech	.79529	.09058	.29655
Telephone speech	.70471		.30561
TOTALS	.75000		.30424

The summary table for the analysis of variance is presented in Table 18. Inspection of this summary table indicates that for Physical Size there were three significant F statistics. Two of these were for the main effects spontaneous as opposed to prepared speech and normal as opposed to telephone speech. As indicated in Table 17, the difference in terms of the spontaneous-prepared factor was due to a significantly higher performance by the listener subjects under the prepared condition than under the spontaneous condition. In terms of the normal-telephone factor,

the significant F came from the listener subjects performing better under the condition of normal speech than under the condition of telephone speech.

Table 18.--Summary of analysis of variance comparing the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener performance for the Physical Size characteristic.

Source of Variation	df	Mean Square	F*
Between subjects	137		
Training (A)	1	0.1467	1.76
Ss within groups	136	0.0835	
Within subjects	414		
Spontaneous-Prepared (B)	1	1.3207	17.27#
A X B	1	0.0290	0.38
B X Ss within groups	136	0.0765	
Normal-Telephone (C)	1	1.1322	12.52#
A X C	1	0.0652	0.72
C X Ss within groups	136	0.0904	
B X C	1	1.0435	10.87#
A X B X C	1	0.0888	0.92
B X C X Ss within groups	136	0.0965	

*$F \geq 3.84$ required for significance at the .05 level, with 1, 136 df.

#Significant beyond the .05 level.

The third significant F mentioned above was for the spontaneous-prepared and normal-telephone interaction. The

individual treatment combination means for this interaction are represented graphically in Figure 9.

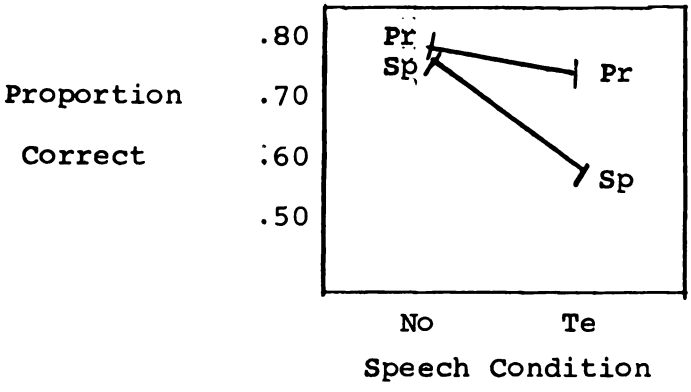

Figure 9.--Graphic representation of the individual treatment combination means for the spontaneous-prepared and normal-telephone interaction on the Physical Size characteristic.

A Newman-Keuls difference of means test, as described above, was performed to determine the origin of the significance. The following results were obtained:

SpTe SpNo PrTe PrNo

These results indicate that the listener subjects were able to attain the highest mean proportion correct under the prepared normal treatment combination. In addition, they indicate that significantly higher means were obtained under the spontaneous normal, prepared telephone, and prepared normal treatment combinations than were obtained under the spontaneous telephone combination, but that these higher means did not differ from each other. Also, it can be seen

that the means for the two prepared (PrNo and PrTe) and two normal (SpNo and PrNo) treatment combinations did not differ from each other while the two spontaneous (SpNo and SpTe) and two telephone (SpTe and PrTe) treatment combinations did. That is, within the spontaneous speech treatment combination, the listener subjects were able to identify correctly a significantly larger proportion of the physical size speech samples when they heard them under the normal speech condition than when they heard them under the telephone speech condition. Likewise, within the telephone speech treatment combinations, they correctly identified a significantly larger proportion of these speech samples when they heard them under the prepared condition than when they heard them under the spontaneous condition. Finally, it is interesting to note that all of the interactions encountered to this point, i.e., under the Ethnic Group, Education, and Physical Size characteristics, have involved the spontaneous-prepared and normal-telephone treatment combinations and, that in each case, the prepared normal treatment combination has been the highest in terms of mean proportion correct.

The product-moment correlation coefficients for test-retest reliability for each treatment under the three main effects for physical size are presented in Table 19.

Inspection of the coefficients in Table 19 indicates relatively consistent test-retest reliability under the

various treatments. However, as before, they leave much to be desired in terms of explained variance.

Table 19.--Product-moment correlation coefficients for test-retest reliability on the physical size characteristic for trained and untrained subjects, spontaneous and prepared speech samples, and normal and telephone speech samples.

Treatment	Correlation Coefficient
Untrained subjects	.51
Trained subjects	.54
Spontaneous speech	.53
Prepared speech	.48
Normal speech	.44
Telephone speech	.59

Dialect Region.--The sixth and final 2 X 2 X 2 analysis of variance for repeated measures was performed to evaluate the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener subject identifications of the Dialect Region characteristic. The mean proportion correct under each treatment of the three main factors and their differences and standard deviations are presented in Table 20.

The summary table for the analysis of variance is presented in Table 21. Inspection of this table indicates the presence of two significant F statistics. These were for the main effect normal-telephone speech samples and, as

before, for the spontaneous-prepared and normal-telephone interaction. By inspection of Table 20, it can be seen that the significant F for the main effect was due to the listener subjects obtaining a significantly larger proportion correct for the Dialect Region characteristic under conditions of telephone speech than under conditions of normal speech. In terms of the significant interaction effect, the individual treatment combination means are presented graphically in Figure 10.

Table 20.--Mean proportion correct and standard deviation for each treatment and differences between the treatment means of the three main factors for the Dialect Region characteristic.

Treatment	Mean	Difference	Standard Deviation
Untrained subjects	.66489	.01583	.27657
Trained subjects	.68072		.26189
Spontaneous speech	.69293	.04025	.24818
Prepared speech	.65268		.28774
Normal speech	.61241	.12289	.28578
Telephone speech	.73420		.23656

Table 21.--Summary of analysis of variance comparing the effects of listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener performance for the Dialect Region characteristic.

Source of Variation	df	Mean Square	F*
Between subjects	137		
Training (A)	1	0.3460	0.49
Ss within groups	136	0.0700	
Within subjects	414		
Spontaneous-Prepared (B)	1	0.2236	3.60
A X B	1	0.0437	0.70
B X Ss within groups	136	0.0620	
Normal-Telephone (C)	1	2.0807	33.37#
A X C	1	0.1993	3.20
C X Ss within groups	136	0.0623	
B X C	1	1.4031	20.60#
A X B X C	1	0.2510	3.68
B X C X Ss within groups	136	0.0681	

*$F \geq 3.84$ required for significance at the .05 level, with 1, 136 df.

#Significant beyond the .05 level.

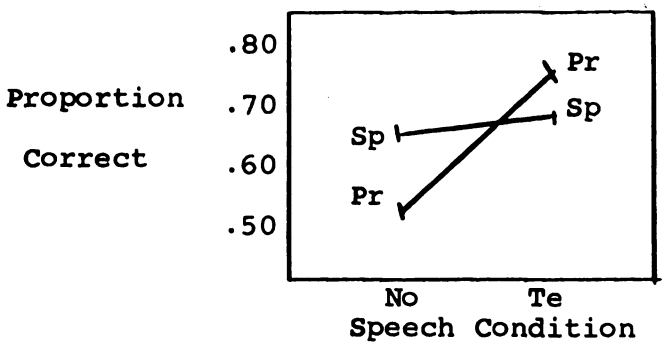

Figure 10.--Graphic representation of the individual treatment combination means for the spontaneous-prepared and normal-telephone interaction on the Dialect Region characteristic.

The test for differences between means yielded the following results:

PrNo	SpNo	SpTe	PrTe

Thus it can be seen that significantly higher mean performance was obtained under the prepared telephone treatment combination than under any of the other three. It will be recalled that on occasions when this interaction effect has been significant on other characteristics, i.e., Ethnic Group, Education, and Physical Size, the highest mean correct performance was obtained under the prepared normal treatment combination. However, as indicated above, under the Dialect Region characteristic, the mean proportion correct under this treatment combination was significantly lower than any of the other three treatment combination means. Also, within the two prepared speech treatment combinations (PrNo and PrTe), it can be seen that the listener subjects were able to identify correctly a significantly higher mean proportion of the telephone speech samples correctly than of the normal speech samples. This same relationship holds within the two spontaneous treatment combinations (SpNo and SpTe) but the differences are not significant. Within the two telephone treatment conditions (SpTe and PrTe), significantly higher means were obtained under the prepared condition than under the spontaneous condition. Under the two normal conditions (SpNo and PrNo), however, this pattern was reversed. The listener subjects obtained significantly

higher means under conditions of spontaneous speech than they did under conditions of prepared speech.

The product-moment correlation coefficients for test-retest reliability for each treatment under the three main effects for dialect region are presented in Table 22.

Table 22.--Product-moment correlation coefficients for test-retest reliability on the dialect region characteristic for trained and untrained subjects, spontaneous and prepared speech samples, and normal and telephone speech samples.

Treatment	Correlation Coefficient
Untrained subjects	.49
Trained subjects	.41
Spontaneous speech	.52
Prepared speech	.40
Normal speech	.46
Telephone speech	.40

Inspection of the coefficients in Table 22 again indicates relatively consistent test-retest reliability among the various treatments, especially for the trained and untrained listener subjects and for normal and telephone speech samples. As before, however, these relationships are not encouraging from the standpoint of accounting for the variation between the two tests.

The following null hypotheses were tested by the six three-way analyses of variance described above:

2. There will be no significant difference in the performance of trained and untrained listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone.

3. There will be no significant difference in the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone under the conditions of presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech.

4. There will be no significant difference in the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone under the conditions of spontaneous presentation of the message (extemporaneous speech) and prepared presentation of the message (oral reading).

5. There will be no significant interaction effect between training and presentation of the message by means of normal speech as opposed to presentation of the message by telephone speech on the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone.

6. There will be no significant interaction effect between training and spontaneous presentation of the message as opposed to prepared presentation of the message on the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone.

7. There will be no significant interaction effect between presentation of the message by means of normal speech as opposed to presentation of the message by means of tele-speech and spontaneous presentation of the message as opposed to prepared presentation of the message on the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone.

8. There will be no significant interaction effects among training, presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech, and spontaneous presentation of the message as opposed to prepared

presentation of the message on the performance of listeners in identifying correctly each of the speaker characteristics in question on the basis of aural cues alone.

Null hypothesis number two, dealing with the effects of training, is not rejected. Although the mean correct performance of the trained listener subjects was higher in magnitude than the mean correct performance for the untrained listener subjects on all speaker characteristics, no significant F statistics were obtained for this effect.

For null hypothesis number three, dealing with the effects of normal speech samples as opposed to telephone speech samples, partial rejection is possible. Specifically, it is rejected for the Age, Physical Size, and Dialect Region speaker characteristics but not for the Sex, Ethnic Group, and Education characteristics.

Partial rejection is also possible for null hypothesis number four, dealing with the effects of spontaneous as opposed to prepared speech. Listener subject performance was significantly affected by this factor for the Age, Ethnic Group, and Dialect Region characteristics. Rejection was not possible for the Sex, Education, and Physical Size characteristics.

The remaining four null hypotheses (five through eight) are concerned with interaction effects. It will be recalled that only one such effect was significant for the above analyses. This, of course, was the spontaneous-prepared and normal-telephone combination. Thus, the fifth

sixth, and eighth null hypotheses listed above, dealing with the training by normal as opposed to telephone speech interaction, the training by spontaneous as opposed to prepared speech interaction, and the three factor interaction, cannot be rejected. In terms of the seventh null hypothesis, however, partial rejection is possible. Significant results were obtained on the spontaneous-prepared by normal-telephone interaction for the Ethnic Group, Education, Physical Size and Dialect Region characteristics. Rejection is not possible for the Sex and Age characteristics.

Duration.--The final analysis of variance was a four-way procedure (2 X 3 X 2 X 2) testing the effects of speech sample duration in conjunction with the other three factors on listener subject performance over all speaker characteristics. As such, the effects of interest were only those involving the duration factor.

The mean proportion correct for each treatment of the duration factor over all speaker characteristics and their standard deviations are presented in Table 23.

The summary table for the analysis of variance is presented in Table 24. Inspection of this table indicates that four significant F statistics were obtained, two of which are not of interest in terms of the questions and null hypotheses posed. One of these significant effects that is not of interest was obtained for the training effect. This lack of interest is based upon the tests for the training

effect for each individual characteristic as described in the above sections. The obtained result, however, is interesting from the standpoint that the training factor was not significant for any of the individual characteristics. This over-all significance is evidently due to the fact that the trained listener subjects obtained a numerically higher mean proportion correct than the untrained listener subjects on every characteristic with the exception of one (Ethnic Group, see Table 11).

Table 23.--Mean proportion correct and standard deviation for each treatment of the duration factor over all speaker characteristics.

Treatment	Mean	Standard Deviation
5 second speech samples	.69176	.11299
10 second speech samples	.75740	.09251
15 second speech samples	.68772	.09381

The second significant F that is not of interest was obtained for the over-all normal-telephone effect. The same reasoning in terms of non-interest stated for the over-all training effect applies here. It should also be noted that this normal-telephone factor had significant effects upon listener subject performance under the Age, Physical Size, and Dialect Region characteristics.

Table 24.--Summary of analysis of variance comparing the effects of listener training, spontaneous as opposed to prepared speech, normal as opposed to telephone speech and duration of the speech samples on listener performance over all speaker characteristics.

Source of Variation	df	Mean Square	F
Between subjects	137		
Training (A)	1	6.7697	6.39*
Duration (B)	2	28.1541	26.58#
A X B	2	3.8330	3.61#
Ss within groups	132	1.0593	
Within subjects	414		
Spontaneous-Prepared (C)	1	2.2225	2.88
A X C	1	0.5510	0.71
E X C	2	1.9815	2.57
A X B X C	2	0.1904	0.24
C X Ss within groups	132	0.7710	
Normal-Telephone (D)	1	5.0976	6.02*
A X D	1	0.8628	1.02
B X D	2	1.8668	2.23
A X B X D	2	2.5338	2.98
D X Ss within groups	132	0.8461	2.98
C X D	1	0.7028	0.78
A X C S D	1	2.5359	2.80
B X C S D	2	2.4605	2.72
A X B X C X D	2	1.8787	2.07
C X D X Ss within groups	132	0.9046	

*Significant beyond the .05 level with 1, 132 df.

#Significant beyond the .05 level with 2, 132 df.

It can be noted in Table 24 that significant overall results were obtained under the duration effect. A test of differences between means for this factor indicated the

following results. The numerals 5, 10, and 15 represent the three speech sample durations.

15 5 10

These results indicate that the over-all mean obtained under the ten second duration condition was significantly larger than those obtained under the five and 15 second speech sample durations. Interestingly enough, the lowest performance by the listener subjects was obtained under the 15 second duration condition. It should be noted, however, that this over-all mean was not significantly lower than the over-all mean obtained under the five second condition. The remaining significant F was obtained for the interaction involving the duration factor and the factor of listener training. The individual treatment combination means for this interaction are presented graphically in Figure 11.

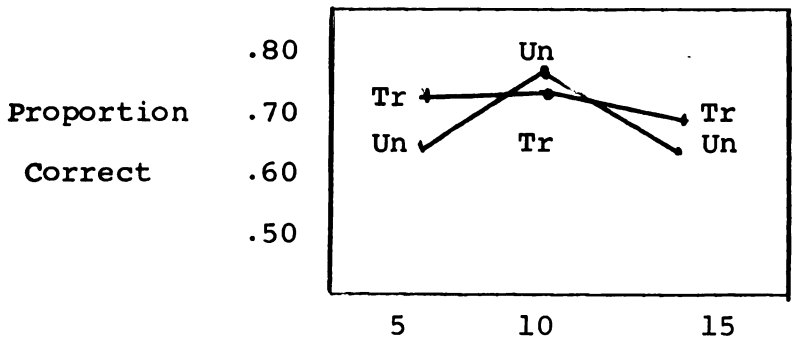

Figure 11.--Graphic representation of the individual treatment combination means for the duration and training interaction over all speaker characteristics.

A difference of means test was performed on this combination with the following results.

Un15 Un5 Tr15 Tr5 Tr10 Un10

These results indicate that significantly higher means were obtained under the ten second duration condition for both the trained and untrained groups. In addition, it can be noted that the trained groups making identifications under the five and 15 second duration conditions performed significantly better than did the untrained groups under these two duration conditions. The fact that the order of the magnitude of the five and 15 second duration means remained the same for the trained and untrained groups is consistent with the significant main effect for duration described above.

The product-moment correlation coefficients for the test-retest reliability under each treatment of the duration factor over-all characteristics are presented in Table 25.

Table 25.--Product-moment correlation coefficients for test-retest reliability over-all speaker characteristics for five, ten, and fifteen second speech samples.

Treatment	Correlation Coefficient
5 second speech samples	.51
10 second speech samples	.50
15 second speech samples	.39

Table 25 indicates that test-retest correlations under the three treatments of duration were relatively consistent from treatment to treatment. It is interesting to note that the lowest test-retest reliability was obtained under the longest duration condition.

The following null hypotheses were tested by the four-way analysis of variance described above:

9. There will be no significant difference in the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone under three conditions of speech sample duration: (1) five sec; (2) ten sec; and (3) 15 sec.

10. There will be no significant interaction effect between training and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone.

11. There will be no significant interaction effect between presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone.

12. There will be no significant interaction effect between spontaneous presentation of the message as opposed to prepared presentation of the message and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone.

13. There will be no significant interaction effects among training, presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech, and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone.

14. There will be no significant interaction effects among training, spontaneous presentation of the message as opposed to prepared presentation of the message, and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone.

15. There will be no significant interaction effects among presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech, spontaneous presentation of the message as opposed to prepared presentation of the message, and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone.

16. There will be no significant interaction effects among training, presentation of the message by means of normal speech as opposed to presentation of the message by means of telephone speech spontaneous presentation of the message as opposed to prepared presentation of the message, and duration of the speech sample on the performance of listeners in identifying correctly the speaker characteristics in question on the basis of aural cues alone.

Table 24 indicates that only null hypotheses nine and ten can be rejected. In terms of null hypothesis number nine, the results showed that the listener subjects were able to perform significantly better over all characteristics under the ten second duration condition than under the five second durations.

Rejection of the tenth null hypothesis was possible on the basis of the significant interaction effect obtained for the training and duration treatment combination.

The hypotheses stated above that were not rejected (11 through 16) were all null statements regarding interactions

between duration and training, spontaneous-prepared speech, and normal-telephone speech treatment combinations.

Discussion

Several questions were posed at the outset of this study regarding listener identifications of the speaker characteristics Sex, Age, Ethnic Group, Education, Physical Size, and Dialect Region. These questions are re-stated in the following sections with an effort made to answer them in terms of the present results.

The first question asked whether or not listener subjects could correctly identify each of the speaker characteristics, and if so, to what degree are these identifications reliable. Research was cited in Chapter II that suggested an affirmative answer to this question for some of the characteristics. For others, however, the only information available was in terms of possible differentiating vocal characteristics.

Sex.--It can be noted in Table 3 that the listener subjects were able to identify correctly the sex of speakers 99 per cent of the time across all training, speech, and duration conditions. This performance was significantly higher than what was expected on the basis of chance.

As indicated in Table 2 of this chapter, the optimum and habitual pitch levels used by the tenors and contraltos

utilized as speakers under this characteristic were somewhat higher than normal in the case of the males and somewhat lower than normal in the case of females. Direct comparisons can be made to the findings of Fletcher[236] (see Table 1, Chapter II). He found that the mean fundamental frequency for male speakers producing pure vowels was 125 Hz. By converting the musical scale to the frequency scale it can be seen in Table 2 that the males used as speakers under the Sex characteristic averaged approximately 154 Hz. More specifically, speakers one, two, and three, i.e., the male speakers used on the master tapes, had habitual pitches that averaged 156 Hz. This appears to be somewhat different than the figure Fletcher[237] cited as "normal." For females, Table 1 suggests a normal fundamental frequency of 244 Hz. In terms of the present speakers, conversion of the musical notes in Table 2 indicates a mean habitual pitch of 231 Hz. Again, more specifically, speakers seven, eight, and nine, i.e., the female speakers used on the master tapes, had habitual pitches that averaged 235 Hz. This fundamental is somewhat lower than the "normal" as cited by Fletcher.[238] However, the difference between the female contraltos measured in the present study and the measurements presented in Table

---

[236] Fletcher, op. cit., p. 62.

[237] Ibid.

[238] Ibid.

1 for females in general is not as large as the difference between the two male samples.

The important feature of these differences in terms of the present investigation is whether or not they influenced the identifications of the listener subjects on the Sex characteristic. By inspecting the original answer forms for the test condition, it was found that the Sex characteristic was incorrectly identified on only 12 occasions out of a possible 3,192 (138 listener subjects judging four speech samples for each of six speakers, three males and three females). Thus, it appears that, for the general case, what differences in pitch that were demonstrated did not seriously affect listener judgments in terms of sex.

In terms of individual items, five of the twelve occations upon which the Sex characteristic was identified incorrectly involved a male speaker being mistaken for a female. In addition, on all five of the instances in which a male speaker was misjudged as a female, the same male speaker provided the stimulus--Sex speaker number one. It can be seen by Table 2 that this speaker's habitual pitch was measured as being D_3 or approximately 145 Hz. This level is approximately one musical note or 20 Hz above the normal as cited by Fletcher.[239] However, the fact that Sex speaker number two, a male whose habitual pitch was measured as G_3,

---

[239] Ibid.

approximately 195 Hz, a pitch higher than that of Sex speaker one, was not, on any occasion, misjudged as a female is an argument against the hypothesis that Sex speaker number one was misjudged as a female soley because of his pitch level.

In terms of females being misjudged as males, five of the total of seven such misjudgments involved Sex speaker number seven. It can be noted in Table 2 that this speaker's habitual pitch was measured as A_4, a frequency of approximately 230 Hz. The small difference between this pitch and the normal (244 Hz) for females as cited by Fletcher[240] again cannot be the sole reason for the misjudgments. This is supported by the fact that the other two occasions for females being misjudged for males involved Sex speaker number eight. Inspection of Table 2 indicates that this female speaker's habitual pitch was measured as B_4, approximately 245 Hz and virtually identical to the cited normal in Table 1.

Age.--Table 3 indicates that the listener subjects were able to identify correctly the Age characteristic 67 per cent of the time across all training, speech, and duration conditions. This performance was significantly higher than what was expected on the basis of chance. It is also consistent with the previous research in terms of objective studies in this area. In terms of specific proportions, however, the obtained performance in the present investigation

---

[240] Ibid.

was somewhat lower than the 99, 87, and 78 per cent correct performances of Ptacek and Sander's subjects.[241] These differences may well be due to the different listeners employed. It will be recalled that these two authors obtained 99 per cent correct performance on oral reading speech samples using graduate students in Speech Pathology and Audiology as listeners. Also, the evaluation required by these listeners was of a lower order than the differentiation required of the listeners in the present study. These authors asked only that their listeners differentiate between young adults (under age 35) and older speakers (over age 65). One might expect better performance under these conditions than when differentiations among three specific ranges are requested.

In terms of the individual listener subject identifications, it was noted that misjudgments tended to move toward the center dimension. That is, when the age group of the 20 to 30 year old speakers was misjudged, the error tended to be the result of listeners judging them as being between 40 and 50 years of age. This same error occurred for the 60 to 70 year old speakers. In addition, it was noted that the extremes, i.e., the 20 to 30 year old speakers and the 60 to 70 year old speakers were identified correctly more often than the 40 to 50 year old speakers. Two speakers, one in

---

[241] Ptacek and Sander, loc. cit.

the 20 to 30 year old group and one in the 60 to 70 year old group, were consistently misjudged. The errors in terms of the younger speaker were evenly distributed between the 40 to 50 and 60 to 70 year old categories. The errors in terms of the older speaker were limited in judging him as being 40 to 50 years of age.

Ethnic Group.--Table 3 indicates that the listener subjects were able to identify correctly the Ethnic Group characteristic 64 per cent of the time across all training, speech, and duration conditions. This performance, as were those for Sex and Age, was significantly higher than what was expected on the basis of chance.

Inspection of the individual answer forms indicated that almost all of the errors made by the listener subjects for this characteristic consisted of misjudging speech samples furnished by Negro speakers. Caucasian speech samples were evaluated as being uttered by a Negro. In terms of individual speakers, one Negro man was consistently identified as Caucasian and one was consistently identified correctly. This suggests the influence of the vocal stereotypes so frequently referred to in Chapter II.

The results for this characteristic show need for further investigation. Of particular interest would be studies involving more precise controls in terms of the speakers. It appears evident from the literature discussed

in Chapter II that what is frequently referred to as "Negro dialect" is a cultural or environmental phenomenon. This factor played an important part in the selection of a label for the present speaker characteristic. As such, more control could be exercised in speaker selection than was used in the present study. For example, practically all Negro families now residing in Michigan at one time migrated to this state from the South. With this in mind, it would appear logical to expect some speech differences on the basis of when this migration occurred. That is, one would not expect the speech of a child whose parents migrated to Michigan from the South to be representative of the typical General American dialect. The same would be true for a child whose grandparents had migrated to this state from the South. The cultural effects on speech and language behavior discussed under education in Chapter II may also be of interest in terms of Negro speakers.

Education.--Table 3 indicates that the listener subjects were able to identify correctly the Education characteristic 55 per cent of the time across all training, speech, and duration conditions. This performance was also significantly higher than what was expected on the basis of chance. In terms of the literature reviewed in Chapter II, this result is not consistent with the results obtained by Fay and Middleton with regard to listeners differentiating between

intelligence levels[242] and leadership ability.[243] However, it is consistent with the studies reviewed in terms of the relationships of social status, occupational success, and cultural background with speech and language behavior.

In terms of individual identifications, as with the Age characteristic, errors tended to consist of evaluating the speech samples of speakers with less than a high school education and those of college graduates as coming from speakers with a high school education. One of the speakers in the less than a high school graduate category was consistently judged as being a high school or a college graduate. Two of the college graduate speakers were misjudged by approximately half of the listener subjects. These errors consisted of identifying their speech samples as being representative of a high school graduate most frequently. Interestingly enough, this stereotyping did not occur on all of their speech samples. For one speaker, there was high listener agreement in terms of his being a high school graduate or lower on only one of his four speech samples. For the other college graduate speaker, however, this stereotyping appeared to occur on three of four speech samples.

---

[242]Fay and Middleton, "Judgment of Intelligence from the Voice as Transmitted over a Public Address System."

[243]Fay and Middleton, "Judgment of Leadership from the Transmitted Voice."

Physical Size.--Table 3 indicates that the listener subjects were able to identify correctly the Physical Size characteristic 75 per cent of the time across all training, speech, and duration conditions. This performance was significantly higher than what was expected on the basis of chance.

Inspection of the individual answer forms did not indicate the presence of stereotyping as has been suggested for some of the other characteristics. The absence of this consistent error is evident in part by the relatively large mean proportion correct obtained by the listener subjects.

Dialect Region.--Table 3 indicates that the listener subjects were able to identify correctly the Dialect Region characteristic 67 per cent of the time across all training, speech, and duration conditions. This performance was significantly higher than what was expected on the basis of chance. This result demonstrates that the differentiating features of the three dialect as described in Chapter II could be accurately categorized by the listener subject.

As might be expected, the primary errors in listener subject identifications for this characteristic were of two types: (1) misjudging Eastern speakers as Southern speakers and (2) misjudging speakers from both of these regions as General American speakers. No real evidence of vocal stereotyping, i.e., listener subjects consistently erroneously identifying a speaker as belonging to a particular dialect

region, was noted. The errors mentioned above seemed to occur on specific speech samples rather than for particular speakers as a general rule.

Further study of this speech characteristic in the future may become more interesting. With increased facilities, interest, and time for travel by residents of all regions of the country, speech boundaries and differences cannot help but undergo modifications. These changes are already occurring to some extent. Physical boundaries such as the Green and Berkshire Mountain Ranges which used to separate the Eastern dialect region from the rest of the country have been eliminated by transportation improvements and a growing interdependency among the various areas of the United States. Speech region boundaries are also being broken down by occupational changes. The South, for example, is no longer unified by its primary agricultural crop--cotton. In addition, with increased transportation facilities, we are seeing children frequently settle in a different part of the country than their parents, perhaps long distances from where they grew up.

Thus, it can be seen in response to the first question that all speaker characteristics were identified by the listener subjects to a degree that was greater than chance occurrence. However, with regard to the second portion of this question, i.e., reliability of the identifications, the results are not as favorable. Inspection of Table 4

indicates that the highest test-retest reliability obtained was + .71 for the Ethnic Group characteristic. These correlations indicate, despite the close agreement of the retest means (also shown in Table 4) with the test means (Table 3), that a given listener subject's score on the retest cannot be predicted with desirable accuracy from his score on the test. That is, even for the highest obtained correlation coefficient, only 50 per cent of the variation in listener subject performance on the retest can be accounted for by the variation in listener subject performance on the test. It appears, then, that despite the close agreement between test and retest means, the magnitude of the correlation coefficients places severe limitations upon the usefulness of the demonstrated success of the listener subjects in correctly identifying the characteristics.

In addition, it can be seen in Tables 7, 10, 13, 16, 19, 22, and 25 that, for the most part, reliability was not altered by the treatment effects. The effects of training on test-retest reliability were mixed. For four of the six characteristics, the trained listener subjects obtained smaller correlation coefficients than the untrained group. In terms of the spontaneous as opposed to prepared speech factor, the spontaneous condition produced higher test-retest reliability than did the prepared speech condition. Results under the normal-prepared factor were mixed as for the training factor. The normal speech condition produced the highest

reliability for the Sex, Age, and Dialect Region characteristics while for the Ethnic Group, Education, and Physical Size characteristics, the highest test-retest reliability was obtained under telephone speech conditions. The highest test-retest correlation coefficients under the various treatments were obtained for the Ethnic Group characteristic and here the magnitude of some r's approaches what would be desirable. As indicated by the above discussion, however, for the most part, the coefficients obtained can only lead one to conclude that the test-retest reliability was poor for the task under investigation. For this reason, no tests of significance were performed on the over-all correlations and no tests of differences were made between the correlations obtained under the various treatments for any of the characteristics. It was felt that because of the insufficient magnitude of the r's, the presence or absence of statistical significance or significant differences was irrelevant.

The test-retest reliability obtained was particularly low for the Sex characteristic. One would expect a high test-retest correlation for this characteristic, both on the basis of the logical ease of making such identifications and from the standpoint of the excellent performance demonstrated by the listener subjects. The ease of this task for the listener subjects is shown not only by their obtaining 99 per cent correct in their identifications, but also by the relatively low standard deviation in their performance. As

shown in Table 4, this statistic was .07 for the Sex characteristic. The standard deviations obtained under the other five characteristics are shown in Tables 8, 11, 14, 17, and 20. Inspection of these tables indicates standard deviations ranging from .27 for the Age and Dialect Region characteristics to .36 for the Ethnic Group characteristic. These statistics are somewhat larger than the .07 standard deviation obtained under the Sex characteristic.

In spite of the fact that this low standard deviation lends support to the relative ease of the task, it does not contribute to obtaining high test-retest correlations. McNemar[244] has pointed out that when a sample is restricted in range, the correlation obtained will be relatively low. This point is also supported by Peters and VanVoorhis.[245] They indicated that when the coefficient of reliability of a test is given, it is important to know the ranges of the distributions from which the r was computed. They stated that the size of a coefficient of correlation is very much affected by the heterogeneity of the population on which it is computed and gave examples showing that the more homogeneous the distribution is, the less likelihood there is of obtaining high reliability. The two distributions in question

---

[244]Quinn McNemar, Psychological Statistics (New York: John Wiley and Sons, 1962), p. 144.

[245]Charles C. Peters and Walter R. VanVoorhis, Statistical Procedures and Their Mathematical Bases (New York: McGraw-Hill Book Co., 1940), p. 208.

here both have very narrow ranges. This can be noted by the data in Appendix F. The obtained *r* of .27 on this set of test and retest scores indicates that given a listener subject's test score and the linear prediction rule, the possibility of predicting the retest score for that listener subject would be small. Inspection of the data, however, indicates that regardless of a listener subject's test score, his retest score was practically always a proportion of 1.00. The reverse was also true. Regardless of a listener subject's retest score, his test score was practically always a proportion of 1.00. In this way, the narrow ranges of these distributions severely limited the extent to which a linear relationship could be established between these two sets of data and reduced the value of the linear prediction rule and the *r* in describing the relationship.

The second question asked whether or not training made a difference in the performance of listeners in identifying correctly each of the speaker characteristics on the basis of aural cues. As pointed out above, a negative answer to this question is indicated by the results of the analyses of variance performed on each speaker characteristic. This is true even though the mean proportion correct obtained by the trained listener subjects was numerically higher than the mean proportion correct obtained by the untrained listener subjects for all but one of the characteristics.

Except for Ethnic Group, the means for the trained and untrained groups were identical.

The most obvious explanation for these obtained results is that the training program was inadequate. This is suggested by the fact that exposure to the program made no difference in the performance of the listener subjects. That is, they performed as if they had not been trained. If this is where the fault lies, alterations in the training procedures are indicated. Possibilities for such changes would include a longer training experience and more opportunity for practice, repetition of or increased content, and spaced sessions.

Another possible explanation for the similar performance of the two sets of listener subjects lies in the procedures actually used. It will be recalled that the training program immediately preceded the administration of the actual test. The identification task for the trained listener subjects, then, involved approximately an hour and a half of steady work. As a result of this, it may be possible that the depressed performance of the trained listener subjects is a reflection of boredom or fatigue rather than inadequacy of the program itself.

Another possible explanation that must be considered is that the nature of the task may not lend itself to training. That is, perhaps listener identification of speaker characteristics cannot be improved by training. This

possibility may be especially indicated for the Sex characteristic. In considering this explanation, however, it should be noted that in terms of numerical results, the trained groups consistently demonstrated better performance on the task than did the untrained groups. This was true even for the Sex characteristic and casts doubt on the possibility that training cannot, when properly administered, improve listener performance in identifying the characteristics in question.

It seems probable that the best solution in terms of training lies in the combination of the first two suggestions. That is, that the training program be altered to include several short periods of training and practice and that the actual test be administered during a separate session.

The third question asked whether or not making their identifications from normal as opposed to telephone speech conditions had a differential effect upon the performance of the listener subjects. The results indicated an affirmative answer for three of the speaker characteristics--Age, Physical Size, and Dialect Region. However, these results were not consistent in terms of favoring one speech condition over the other. For Age and Dialect Region, listener subjects performed significantly better under the normal speech condition. In terms of the latter characteristic, Physical Size, it would appear that some differentiating cue was available to the listeners under the normal speech condition

that was not available to them under the telephone speech condition. As indicated in Chapter II, large male speakers are stereotyped as having a low pitched, relatively intense voice. It is possible that under the filtering conditions imposed by telephone speech, as indicated in Figure 3, Chapter III, these vocal features were altered to an extent to make differentiation between the big speakers and the small speakers, with their stereotyped higher pitched, less intense voices, more difficult. This hypothesis suggests further investigation of the present data in the form of inspection of individual speech samples and the corresponding listener identifications made on them.

In terms of the significantly higher mean performance under telephone speech conditions for Age and Dialect Region, it appears logical to assume that these characteristics are more often evaluated by listeners while using the telephone. That is, possibly, the difference in the obtained means was due to the listener subjects being more accustomed to making judgments such as those required for Age and Dialect Region under conditions of telephone speech than under conditions of normal speech.

The fourth question asked whether or not making their identifications from spontaneous as opposed to prepared speech samples had a differential effect upon the performance of the listener subject. The results indicated an affirmative answer for three of the speaker characteristics--Age,

Ethnic Group, and Physical Size. Again, however, these results were not consistent in terms of favoring one speech condition over the other. For Ethnic Group and Physical Size, significantly better performance was obtained under prepared speech conditions. The opposite was true for the Age characteristic. The results in terms of the first two characteristics, Ethnic Group and Physical Size, are difficult, at best, to justify. It would be expected, particularly in terms of Ethnic Group, that the spontaneous speech condition would allow for the presence of considerably more differentiating vocal features. It may be possible, however, that the oral reading involved in the prepared speech condition had some differentiating effect. One might expect, for example, on the basis of cultural influences, that Negro speakers would be less adept in oral reading than Caucasian speakers. In terms of Physical Size, the stereotype of the big, non-academically inclined athlete may have some application to the results. Both of these hypotheses indicate the need for future investigation of individual speech samples.

The fact that the listener subjects performed better in terms of identifying the Age characteristic correctly under spontaneous speech conditions is consistent with expected results. Evidently, this speech condition allowed such differentiating cues as rate, speech hesitancies and vocal inflection patterns that are associated with the age

groups used in the present study to operate while the condition of oral reading evidently tended to mask these differentiating characteristics.

The fifth and sixth questions inquired about interaction effects between listener training and (1) normal as opposed to telephone speech samples and (2) spontaneous as opposed to prepared speech samples. The results indicated that neither of these treatment combinations significantly affected listener performance for any characteristic. It is felt that the remarks set forth above in terms of the inadequacies of the training procedures may have application to these insignificant results.

The seventh question asked whether or not the interaction of the normal-telephone and spontaneous-prepared speech treatment combinations had a significant effect upon listener performance for each characteristic. The results indicate an affirmative answer to this question for Ethnic Group, Education, Physical Size, and Dialect Region. For the first two characteristics, this significance was apparently due to a differential effect of the spontaneous-prepared treatment combinations. That is, within the normal speech treatment combinations, a higher mean was obtained under the prepared condition than under the spontaneous condition. This order was reversed under the telephone treatment combinations. Within this latter factor, the highest of the two

means was obtained under the spontaneous telephone rather than the prepared telephone condition.

In terms of this interaction effect for the Physical Size characteristic, the prepared normal treatment combination again produced the highest mean. For this characteristic, however, the mean obtained under this combination was not significantly different from the means obtained under the prepared telephone and spontaneous telephone treatments. The fact that these three means were not significantly different from each other but were significantly higher than the lowest mean obtained, that for the spontaneous telephone treatment combinations, indicates that the significant over-all effect can be attributed to the latter factor.

For the Dialect Region characteristic, the significant interaction effect of the normal-telephone and spontaneous-prepared treatment combinations was due to a differential result in terms of the latter factor. Within the telephone treatment combinations, significantly higher means were obtained under the prepared speech condition than under the spontaneous speech condition. This trend was reversed under the normal speech treatment combinations. Within this factor a significantly higher mean was obtained under the spontaneous speech condition than under the prepared speech condition.

The final question with respect to the performance of the listener subjects on each speaker characteristic

inquired about the effect of an interaction among listener training, spontaneous as opposed to telephone speech. A negative answer to this question is indicated for all six characteristics.

The remaining questions were inquiries about the effects of duration by itself and in conjunction with listener training, spontaneous as opposed to prepared speech, and normal as opposed to telephone speech on listener subject performance across all speaker characteristics. The first of these questions asked about the main effect of duration. Results indicated that the performance of the listener subjects under the ten second speech sample condition was significantly higher than the performance of the listener subjects exposed to the five and fifteen second speech duration. The listener subjects whose identifications were made under the latter condition obtained the lowest mean proportion correct. This result, while not expected, was consistent with the findings of Morrison[246] to the effect that judges of articulation proficiency preferred five and ten second speech samples to fifteen second samples. She found under the latter condition that judges tended not to listen to the entire sample before making their answers. This tendency was also noted during administration of the test procedures in the present investigation. It was also noted that the

---

[246]Morrison, loc. cit.

listener subjects making their identifications on the basis of the fifteen second samples tended to become more restless and seemingly disinterested in their task than did the listener subjects who were exposed to the other two speech sample durations. It is felt that this evident disinterest may have been the primary contributing factor to the lowest mean performance being obtained under the fifteen second speech sample treatment.

The remaining questions with regard to the effects of duration on listener subject performance over all characteristics were concerned with interactions. The only one of these questions for which the results indicated an affirmative answer asked whether or not the treatment combination of training and duration significantly affected the performance of the listener subjects. It was found that both the trained and the untrained listener subjects exposed to durations of ten seconds in length performed significantly better than did the other groups. In addition, under the five and fifteen second speech sample durations, the trained groups performed significantly better than did the untrained groups.

This chapter has presented and discussed the results obtained by means of the procedures outlined in Chapter III. In summary, it is noted that all six of the speaker characteristics were identified correctly to a degree that exceeded what was expected on the basis of chance. The training factor,

as defined in the present investigation, had no significant effect on listener subject performance for any of the characteristics. Both the normal-telephone and the spontaneous-prepared factors affected the performance of the listener subjects under some characteristics but not others. Finally, listener subject performance in making correct identifications over all characteristics was found to be significantly affected by the duration of the speech sample from which the judgments were made.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The basic purpose of this research was to evaluate the performance of listeners in identifying correctly the speaker characteristics of Sex, Age, Ethnic Group, Education, Physical Size, and Dialect Region on the basis of aural cues alone. Of additional interest were the effects of listener training, normal as opposed to telephone speech, spontaneous as opposed to prepared speech, and speech sample duration on the performance of the listeners.

Summary

Six groups of 23 listener subjects each were selected for this study. Three of the groups were exposed to training procedures while the remaining three served as untrained listener subjects. One trained and one untrained group made identifications of the speaker characteristics listed above on the basis of listening to speech samples under each of the three duration conditions - five seconds, ten seconds, and 15 seconds.

Each listener subject made eight identifications of the Sex, Ethnic Group and Physical Size characteristics, two under each of the following speech treatment combinations:

(1) spontaneous normal speech; (2) spontaneous telephone speech; (3) prepared normal speech; and (4) prepared telephone speech. For the Age, Education, and Dialect Region characteristics, each listener subject made 12 identifications three under each of the above speech treatment combinations.

Speech samples were provided by selected speakers. Six speakers provided the stimuli for identifying the Sex characteristic, three males and three females. The same number of speakers provided the stimuli for the Ethnic Group and Physical size characteristics. These were, repectively, three Negroes and three Caucasians and three big speakers and three small speakers. Nine speakers provided the stimuli for identifying the Age characteristic, three between the ages of 20 and 30 years, three between the ages of 40 and 50 years, and three between the ages of 60 and 70 years. The same number of speakers provided the stimuli for the Education and Dialect Region characteristics. For the former these were three speakers with less than a high school education, three speakers who had graduated from high school and three speakers who were college graduates. For Dialect Region, three speakers were from the East, three were from the South, and three were natives of Michigan. All speakers were males with the exception of the females employed under the Sex characteristic. Speech samples were presented to the listener subjects by magnetic tape. Re-test measures were made 48

hours after administration of the actual test for each group of listener subjects.

Results indicated that all six of the speaker characteristics could be identified correctly by the listener subjects to a degree that exceeded what was expected by chance. Listener training, as defined by the procedures followed in this study, did not have a significant effect upon subject performance under any characteristic. Listening to spontaneous speech samples enabled the listener subjects to make a significantly greater number of correct identifications for the Age characteristic than they could make for this characteristic on the basis of prepared aural cues. This pattern was reversed for the Ethnic Group and Physical Size characteristics. Listener subjects performed significantly better under prepared speech sample conditions than under spontaneous speech sample conditions for these two characteristics. This factor did not significantly affect listener subject performance in correctly identifying the Sex, Education, and Physical Size characteristics.

Partial significance was also found under the normal-telephone speech sample condition. For the Age and Dialect Region characteristics, the listener subjects were able to make a significantly greater number of correct identifications under telephone speech sample conditions than while listening to normal speech. This pattern was reversed for the Physical Size characteristic. For this characteristic, listener sub-

jects made a significantly greater number of correct identifications under the telephone speech conditions.

The effects of speech sample duration were measured over all speaker characteristics. Results indicated that the listener subjects were able to make a significantly greater number of correct identifications on the basis of listening to ten second speech samples than they were able to make on the basis of aural cues of five and 15 seconds in length.

The interaction between the spontaneous-prepared and normal-telephone speech conditions was significant for four of the speaker characteristics. The use of individual comparison procedures indicated that for the Ethnic Group, Education, and Physical Size characteristics, the listener subjects made a greater number of correct identifications under the treatment combination of prepared normal speech than they did under the other treatment combinations. For the Dialect Region characteristic, individual comparisons for this significant interaction indicated that the listener subjects made a greater number of correct identifications under the treatment combination of prepared telephone speech than under any of the other combinations. In addition, under the condition of prepared normal speech samples, they made significantly fewer correct identifications than they did under the other treatment combinations.

The interaction between listener training and speech sample duration also had a significant effect upon listener

performance. This effect appeared to be due to a differential result in terms of training with the three durations. Under the five and 15 second durations, the performance of the untrained listener subjects was significantly lower than was the performance of the trained listener subjects under the ten second duration condition, however, this order did not hold. The untrained listener subjects achieved higher performance, although not significantly so than did the trained listener subjects.

Test-retest correlation coefficients computed for each characteristic over all treatments and under each individual treatment were low. This indicated that while the test-retest means for each characteristic did not appear different from each other, the individual listener subject reliability within each characteristic was poor.

Conclusions

Within the limits of the dimensions employed within each characteristic and present speaker, testing and training procedures in addition to the use of undergraduate college students as listener subjects, the following conclusions seem warranted:

1. Listeners can differentiate accurately between male and female speakers on the basis of a combination of spontaneous (extemporaneous), prepared (oral reading), normal (simulated face-to-face), and telephone aural cues.

2. Listeners can differentiate accurately among 20 to 30 year old speakers, 40 to 50 year old speakers, and 60 to

70 year old speakers on the basis of a combination of spontaneous (extemporaneous), prepared (oral reading), normal (simulated face-to-face) and telephone aural cues.

3. Listeners can differentiate accurately between Negro and Caucasian speakers on the basis of a combination of spontaneous (extemporaneous), prepared (oral reading), normal (simulated face-to-face), and telephone aural cues.

4. Listeners can differentiate accurately among among speakers with less than a high school education, speakers who are high school graduates, and speakers who are college graduates on the basis of a combination of spontaneous (extemporaneous), prepared (oral reading), normal (simulated face-to-face), and telephone aural cues.

5. Listeners can differentiate accurately between big and small speakers on the basis of a combination of spontaneous (extemporaneous), prepared (oral reading), normal (simulated face-to-face), and telephone aural cues.

6. Listeners can differentiate accurately among speakers from the Eastern, Southern, and General American dialect regions of the United States on the basis of a combination of spontaneous (extemporaneous), prepared (oral reading), normal (simulated face-to-face), and telephone aural cues.

7. Listeners taken as a group are highly consistent in differentiating between and among the dimensions specified above on the basis of aural cues, but when these same listeners are considered individually, the same conclusion is not

warranted.

8. The training of listeners in the task of making the above differentiations on the basis of aural cues does not improve significantly their performance.

9. Differentiations among age categories of speakers can be made more effectively on the basis of spontaneous aural cues (extemporaneous speech) than on the basis of prepared aural cues (oral reading).

10. Differentiations between Negro and Caucasian speakers and between big and small speakers can be made more effectively on the basis of prepared aural cues (oral reading) than on the basis of spontaneous aural cues (extemporaneous speech).

11. Differentiations among the age groups of speakers and among speakers from the three dialect regions of the United States can be made more effectively on the basis of aural cues provided by telephone speech than by the aural cues provided under conditions that simulate the acoustical signal received by listeners during face-to-face conversation.

12. Differentiations between big and small speakers can be made more effectively on the basis of the aural cues provided by simulated face-to-face conversation than by aural cues provided by telephone speech.

13. Aural cues of ten seconds in duration are a more effective means by which to make differentiating judgments relative to the sex, age, ethnic group, education level, physical size, and dialect region of speakers than are aural

cues of five, and 15 seconds in duration.

Recommendation for Further Research

As indicated in Chapter I, one of the limitations imposed upon the present investigation at the onset was that it be broad in nature. This decision was based upon the relatively small amount of information available with regard to listener identifications of the speaker characteristics in question on a general basis, and specifically, in terms of such identifications on the basis of differing types of aural cues. Obtaining this knowledge was regarded as being a preliminary step that was necessary before the inter-relationships among the speaker characteristics and among the various training, speech and duration factors could be studied in detain. This approach is illustrated by the questions posed in Chaper I and is consistent with the manner in which each was discussed in Chapter IV relative to the results obtained. Thus, the existing data and speech sample stimuli may contain answers to questions that were not considered appropriate or practical in terms of the nature of the present study. Such questions of interest may be:

1. What are the actual similarities and differences between the speech samples collected for each dimension of the various characteristics and how do these similarities and differences relate to consistent misjudgments of speakers?

2. What are the specific effects of the spontaneous and prepared recording conditions upon such speech characteristics

as grammatical and vocabulary usage, sentence length, speaking length, speaking rate, and so forth? In addition, do trends exist relative to differentiating between the dimensions of each characteristic on the basis of these recording conditions?

3. What are the spectral characteristics of the speech samples recorded under the normal and telephone speech conditions? Do differences that are apparent between speech samples representing different dimensions of a characteristic under the normal speech condition tend to change in some way under the telephone speech condition?

4. What are the specific effects of the three speech sample durations in providing the differentiating vocal features for each speaker characteristic as discussed in Chapter II and discovered by answering the above questions?

5. Is there a consistency of performance for individual listeners in terms of their identifications across and within speaker characteristics and the speech and duration factors?

The following suggestions are made in terms of continued research in the area of listener identificaion of characteristics of speakers on the basis of aural cues:

1. The present results indicate the need for further research on the effects of listener training as it relates to the identification of speaker characteristics.

2. The results of the present investigation also suggest a need for clarifying the demonstrated interrelationship between the normal-telephone and spontaneous-prepared speech

treatment combinations with regard to listener identification. The present results in terms of test-retest reliability indicate the need for further study. This factor is of vital importance with regard to the applicability of results.

3. The present results need to be substantiated by further research on a more detailed basis. Specifically, this substantiation should include the use of greater number of speakers representing the various characteristics and should investigate the possibility of listeners making more precise differentiations within each characteristic.

4. As indicated in Chapter I, as more information becomes available with respect to listener identification of individual characteristics, the need will be evident for studying the interrelationships among such characteristics and the effects of various combinations upon listener performance.

5. The relationship between listener performance in differentiating between speakers on the basis of acoustic cues and the performance of persons in making such differentiations on the basis of visual cues as in voice printing is seen as essential in terms of specifying the important cues for success in each task.

6. Finally, the need for continued study of the Ethnic Group and Dialect Region characteristics is urged from the standpoint of the expected changing nature of the differentiating vocal features within each. The increased tendency

for travel and the reduction of geographical iminations in terms of family location will slowly eliminate the distinctive features of the speech regions of the United States. In addition, the recent and continued activity in the interest of providing equal rights and opportunities for all citizens is expected to be influential in modifying the speech as well as other cultural differences between Negro and Caucasian individuals.

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

Akin, Johnnye. And So We Speak: Voice and Articulation. Englewood Cliffs, N.J.: Prentice-Hall, 1958.

Barbara, Dominick A. Your Speech Reveals Your Personality. Springfield, Ill.: Charles C. Thomas, 1958.

Baugh, Albert C. History of the English Language. New York: Appleton-Century, 1935.

Bell, H.M. Adjustment Inventory. Stanford: Stanford University Press, 1934.

Bernreuter, R. Personality Inventory. Stanford: Stanford University Press, 1931.

Black, Hohn W. and Moore, Wilbur E. Speech: Code, Meaning, and Communication. New York: McGraw-Hill Book Co., 1955.

Blalock, Hubert M. Social Statistics. New York: McGraw-Hill Book Co., 1960.

Fairbanks, Grant. Voice and Articulation Drillbook. New York: Harper and Brothers, 1940.

Fisher, Hilda B. Improving Voice and Articulation. Boston: Houghton Mifflin Co., 1966.

Fletcher, Harvey. Speech and Hearing in Communication. New York: McGraw-Hill Book Co., 1955.

Gray, Giles Wilkerson and Wise, Claude Merton. The Bases of Speech. New York: Harper and Brothers, 1959.

Hahn, E. et al. Basic Voice Training for Speech. New York: McGraw-Hill Book Co., 1957.

Hanley, Theodore D. and Thurman, Wayne L. Developing Vocal Skills. New York: Holt, Rinehart, and Winston, 1963.

Hays, William L. Statistics for Psychologists. New York: Holt, Rinehart, and Winston, 1963.

Kingsley, Howard L. The Nature and Conditions of Learning. Englewood Cliffs, N. J. : Prentice-Hall, 1957.

Kurath, Hans. Linguistic Atlas of the United States. Providence, R.I.: Brown University Press, 1939-1943.

Lojos, Egri. Your Key to Successful Writing. New York: Henry Holt Co., 1952.

McNemar, Quinn. Psychological Statistics. New York: John Wiley and Sons, 1962.

Mednick, Sarnoff A. Learning. Englewood Cliffs, N.J.: Prentice-Hall, 1964.

Murray, Elwood. The Speech Personality. Chicago: J.B. Lippincott Co., 1944.

Pear, T.H. Voice and Personality. London: Chapman and Hall, 1931.

Peters, Charles C. and VanVoorhis, Walter R. Statistical Procedures and Their Mathematical Bases. New York: McGraw-Hill Book Co., 1960.

Postman, Leo and Egan, James P. Experimental Psychology. New York: Harper and Brothers, 1949.

Sullivan, H.S. The Psychiatric Interview. New York: Norton, 1954.

Winer, B.J. Statistical Principles in Experimental Design. New York: McGraw-Hill Book Co., 1962.

Wise, Claude Merton, Introduction to Phonetics. Englewood Cliffs, N.J.: Prentice-Hall, 1958.

Articles and Periodicals

Ackelsber, Sylvia A. "Vocabulary and Mental Deterioration in Senile Psychosis," Journal of Abnormal and Social Psychology, XXXIX (October, 1944), pp. 393-406.

Ainsfield, M., Bogs, N., and Lambert, W. "Evaluational Reactions to Accented English Speech," Journal of Abnormal Psychology, LXV (1962), pp. 223-231.

Allport, Gordon W. and Cantril, Hadley. "Judging Personality from the Voice," Journal of Social Psychology, V (February, 1934), pp. 37-55.

Allport, Gordon W. and Kramer, Bernard M. "Some Roots of Prejudice," Journal of Psychology, XXII (1946), pp. 9-39.

Altus, W.D. "Sexual Role, the Short Story, and the Writer," Journal of Psychology, XLVII (January, 1959), pp. 37-40.

_____. "Inferring the Sex of an Author," Journal of Psychology, XLVIII (October, 1959), pp. 215-218.

Back, A.C., Lederer, Frances C., and Dinolt, R. "Senile Changes in the Laryngeal Musculature," Archives of Otolaryngolgy, XXXIV (July, 1941), pp. 47-56.

"Bees," The World Book Encyclopedia, II (1964), p. 154.

Bernard, B. "Some Sociological Determinents of Perception: An Enquiry into Sub-Cultural Differences," British Journal of Sociology, IX (1958), pp. 159-174.

Bernstein, Basil. "Language and Social Class," British Journal of Sociology, XI (1960), pp. 271-276.

_____. "Linguistic Codes, Hesitation Phenomina, and Intelligence," Language and Speech, V (1962), pp. 31-45.

_____. "Social Class Linguistic Codes and Grammatical Elements," Language and Speech, V (1962), pp. 221-240.

"Birds," The World Book Encyclopedia, II (1964), p. 250.

Birren, James E., Riegel, K.F., and Robbin, J.S. "Age Deficiencies in Continuous Work Associations Measured by Speech Recordings," Journal of Gerontology, XVIII (January, 1962), pp. 95-96.

Blake, Robert R. "The Relationship Between Childhood Environment and the Scholastic Aptitude and Intelligence of Adults," Journal of Social Psychology, XXIX (February, 1949), pp. 37-41.

Bloomer, Harlan. "Communication Problems among Aged County Hospital Patients," Gereatrics, XV (April, 1960), pp. 291-295.

Boshoff, P.H. "The Anatomy of the South African Negro Larynges," South African Journal of Medical Science, X (February, 1945), pp. 35-40.

Britton, Joseph H. "Influence of Social Class upon Performance on the Draw-a-Man Test," Journal of Educational Psychology, XLV (January, 1954), pp. 44-51.

Brown, Mary Marrow. "A Study of Performance on a Deterioration Test Related to Quality of Vocabulary and Rigidity," American Psychologist, III (October, 1944), pp. 393-406.

Bryan, Alec I. and Wilke, Walter H. "A Technique for Rating Public Speeches." Journal of Consulting Psychology, V (March-April, 1941), pp. 80-90.

Carlson, J. Spencer, Cook, Stuart W., and Stromberg, Elroy L. "Sex Differences in Conversation," Journal of Applied Psychology, XX (1939), pp. 727-735.

Carson, Arnold S. and Rabin, A.I. "Verbal Comprehension and Communication in Negro and White Children," Journal of Educational Psychology, LI (April, 1960), pp. 47-51.

Christian, Alice M. and Patterson, Donald G. "Growth of Vocabulary in Later Maturity," Journal of Psychology I (1936), pp. 167-169.

Cohen, Alan and Starkweather, John A. "Vocal Cues to the Identification of Language," American Journal of Psychology, LXXIV (March, 1961), pp. 90-93.

Curry, E.T. "The Pitch Characteristics of the Adolescent Male Voice," Speech Monographs, VII (March, 1940), pp. 48-62.

Diehl, Charles P. "Voice and Personality," Psychological and Psychiatric Aspects of Speech and Hearing, ed. Dominick Barbara. Springfield, Ill.: Charles C. Thomas, 1960.

Dimitrovsky, Lilly Sprecker. "The Ability to Identify the Emotional Meaning of Vocal Expression at Successive Age Levels," Dissertation Abstracts, XXIV (January, 1964), pp. 2983-2984.

Eckert, R.G. and Keys, N. "Public Speaking as a Clue to Personality Adjustment," Journal of Applied Psychology, XXIV (January, 1940), pp. 144-153.

Fairbanks, Grant and Pronovost, Wilbert. "An Experimental Study of the Pitch Characteristics of the Voice During the Expression of Emotion," Speech Monographs, VI (December, 1939), pp. 87-104.

Fay, Paul J. and Middleton, Warren C. "Judgment of Kretschmerian Body Types from the Voice as Transmitted over a Public Address System," Journal of Social Psychology, XXI (January, 1940), pp. 151-162.

_____. "Judgment of Intelligence from the Voice as Transmitted over a Public Address System," Sociometry, III (April, 1940), pp. 186-191.

_____. "Judgment of Leadership from the Transmitted Voice." Journal of Social Psychology, XVII (1943), pp. 99-102.

"Fish," The World Book Encyclopedia, VII (1964), p. 139.

"Flowers," The World Book Encyclopedia VII (1964) p. 234.

Fox, Charlotte. "Vocabulary Ability in Later Maturity," Journal of Educational Psychology, XXXVIII (December, 1947), pp. 482-492.

Fox, Charlotte and Birren, James E. "Some Factors Affecting Vocabulary Size in Later Maturity: Age, Education, and Length of Institutionalization," Journal of Gerontology IV (January, 1949), pp. 19-26.

Gleser, Goldine C., Gottschalk, Louis A., and Watkins, John. "The Relationship of Sex and Intelligence to Choice of Words: A Normative Study of Verbal Behavior," Journal of Clinical Psychology, XV (April, 1959), pp. 182-191.

Harbold, George J. "Pitch Ratings of Voiced and Whispered Vowels," Journal of the Acoustical Society of America, XXX (July, 1958), pp. 600-601.

Hollien, H. "Vocal Pitch Variation Related to Change in Vocal Fold Length," Journal of Speech and Hearing Research, III (June, 1960), pp. 150-156.

Hollien, H. and Curtis, James F. "A Laminographic Study of Vocal Pitch," Journal of Speech and Hearing Research, III (December, 1960), pp. 361-371.

Hollien H. and Malick, Ellen. "Adolescent Voice Change in Southern Negro Males," Speech Monographs, XXIX (March, 1962), pp. 53-58.

Hollingworth, L.S. "What We Know About the Early Selection and Training of Leaders," Teachers College Record, XI (April, 1939), pp. 575-592.

Hunt, W.A. et al. "The Clinical Possibilities of an Abbreviated Individual Intelligence Test," Journal of Clinical Psychology, XII (February, 1948), pp. 171-173.

Knower, Franklin. "A Study of Rank-Order Methods of Evaluating Performance in Speech Contests," Journal of Applied Psychology, XXIV (October, 1940), pp. 633-644.

Kramer, Ernest. "Personality Stereotypes in Voice: A Reconsideration of the Data," Journal of Social Psychology, LXII (April, 1963), pp. 247-251.

_____. "Judgment of Personal Characteristics from Non-Verbal Properties of Speech," Psychological Bulletin, LX (July, 1963), pp. 408-420.

Kurath, Hans. "Dialectical Differences in Spoken English," Modern Philology, XXVI (May, 1928), pp. 386-393.

Landis, C. "National Differences in Conversation," Journal of Abnormal and Social Psychology, XXI (January-March, 1927), pp. 354-357.

Landis, H.H. and Burtt, H.E. "A Study of Conversations," Journal of Comparative Psychology, IV (February, 1924), pp. 81-89.

Lawten, Denes. "Social Class Differences in Language Development: A Study of Some Samples of Written Work," Language and Speech, XI (1963), pp. 120-143.

Licklider, J.C.R. and Miller, George A. "The Perception of Speech," Handbook of Experimental Psychology, ed. S.S. Stevens. New York: John Wiley and Sons, 1951.

McGehee, F. "An Experimental Study of Voice Recognition," Journal of General Psychology, XXXI (January, 1944), pp. 53-65.

McGlone, Robert C. and Hollien, Harry. "Vocal Pitch Characteristics of Aged Women," Journal of Speech and Hearing Research, VI (June, 1963), pp. 164-170.

McKelvey, D.P. "Voice and Personality," Western Speech, XVII (1953), pp. 91-94.

Meyer-Eppler, W. "Realization of Prosodic Features in Whispered Speech," Journal of the Acoustical Society of America, XXIX (January, 1957), pp. 104-106.

Mitchell, Joyce. "Speech and Language Impairment in the Older Patient," Geriatrics, XIII (July, 1958), pp. 467-476.

Moore, Henry T. "Further Data Concerning Sex Differences," Journal of Abnormal and Social Psychology, XVII (July-September, 1922), pp. 210-214.

Morrison, Sheila. "The Severity of Articulation Defectiveness," Journal of Speech and Hearing Disorders, XX (December, 1955), pp. 347-351.

Murray, Elwood. "A Study of Factors Contributing to the Mal-Developing of the Speech Personality," Speech Monographs, III (September, 1936), pp. 95-108.

Mysak, Edward D. "Pitch and Duration Characteristics of Older Males," Journal of Speech and Hearing Research, II (March, 1959), pp. 46-54.

Penny, R. "Age and Sex Differences in Motivational Orientation to the Communicative Act," Child Development, XXIX (December, 1958), pp. 163-171.

Perrin, Elinor Horwitz, "The Rating of Defective Speech by Trained and Untrained Observers," Journal of Speech and Hearing Disorders, XIX (March, 1954), pp. 48-51.

Pronovost, Wibert L. "An Experimental Study for Determining Natural and Habitual Pitch," Speech Monographs, IX (1942), pp. 111-123.

Ptacek, Paul H. and Sander, Erik K. "Age Recognition from Voice," Journal of Speech and Hearing Research, IX (June, 1966), pp. 273-277.

Ptacek, Paul H. et al. "Phonatory and Related Changes with Advanced Age," Journal of Speech and Hearing Research, IX (September, 1966), pp. 353-360.

"Rain," The World Book Encyclopedia, XVI (1964), p. 122.

Reynolds, R.G. "Factors of Leadership Among Seniors of Central High School, Tulsa, Oklahoma," Journal of Educational Research, XXXVII (January, 1944), pp. 356-361.

Ricks, James H. "Age and Vocabulary Test Performance: A Qualitative Analysis of the Responses of Adults," Dissertation Abstracts, XIX (July, 1958), p. 182.

Rosenthal, Fred. "Some Relationships Between Socio-Position and Language Structure of Young Children," Journal of Educational Psychology, XLVII (December, 1957), pp. 483-497.

Schulman, Mary Jean and Havinghurst, Robert J. "Relations Between Ability and Social Status in a Midwestern Community. IV: Size of Vocabulary," Journal of Educational Psychology, XXXVIII (November, 1947), pp. 437-442.

Sewell, William H., Haller, Archie O., and Straus, Murray A. "Social Status and Educational and Occupational Aspiration," American Sociological Review, XXII (February, 1957), pp. 67-73.

Shakow, D., Dolkart, Marjorie, B., and Godlman, Rosaline. "The Memory Function in Psychosis of the Aged," Disorders of the Nervous System, II (January, 1941), pp. 3-8.

Shakow, D. and Godlman, Rosaline. "The Effect of Age on Stanford-Binet Vocabulary Scores of Adults," Journal of Educational Psychology, XXIX (April, 1938), pp. 241-256.

Sherman, Dorothy and Morrison, Sheila. "Reliability of the Individual Ratings of Severity of Defective Articulation," Journal of Speech and Hearing Disorders, XX (December, 1955), pp. 352-358.

Silverstein, B. et al. "The Relative Intelligibility of Male and Female Talkers," Journal of Educational Psychology, XIX (November, 1953), pp. 418-428.

Snidecor, John C. "The Pitch and Duration Characteristics of Superior Female Speakers during Oral Reading," Journal of Speech and Hearing Disorders, XVI (February, 1951), pp. 44-52.

Sorenson, H. "Mental Ability over a Wide Range of Adult Ages," Journal of Applied Psychology, XVII (1938), pp. 729-741.

"Stars," The World Book Encyclopedia, XVII (1964), p. 660.

Stenquist, John L. and Lorge, Irving. "Implications of Intelligence and Cultural Differences; As Seen by a Test-User; As Seen by a Test-Maker," Teachers College Record, LIV (January, 1953), pp. 184-193.

Stoke, Stuart M. and West, Elmer D. "Sex Differences in Conversational Interests," Journal of Social Psychology, II (February, 1931), pp. 120-126.

Tyler, Leona. "Test Review Number 77," The Fourth Mental Measurements Yearbook, ed. O. Buros. New Jersey: Gryphon Press, 1953.

Wolfle, Doel. "Training," Handbook of Experimental Psychology, ed. S.S. Stevens. New York: Wiley and Sons, 1951.

_____. "Military Training and the Useful Parts of Learning Theory," Journal of Applied Psychology, (1946), pp. 73-75.

Wise, C.M. "Negro Dialect," Quarterly Journal of Speech, XIX (November, 1933), pp. 522-528.

Reports

Glick, Paul C. and Miller, Norman P. "Educational Level and Parental Income," College Board Review, No. 32, 1957, pp. 29-32.

Havinghurst, Robert J. "Culture and the I.Q.," Purdue University Studies in Higher Education, No. 69 (1949), pp. 42-53.

Johnson, A.P. "A Study of the English Vocabulary Scores of 75 Executives," Technical Report of the Human Engineering Laboratory, No. 2 (1935), p. 16.

Society of Actuaries. Build and Blood Pressure Study. Volume I, Chicago: Society of Actuaries, 1959.

APPENDIX A

PARAGRAPHS USED
SPEECH STIMULI

Rain[247]

Rain is a necessity for all life. When city dwellers mutter objections during a shower or thunderstorm, they do not realize that millions of both men and animals are gladdened by the falling drops. When rain falls after a long dry spell, all nature undergoes a revival of life. Withering plants and trees become green again, and farmers who had been afraid they would lose their crops have hopes for a harvest. Streams baked almost dry by the summer sun, refill and make it possible for the fish and other water animals to live and multiply. Birds drink gladly from the pools of water.

But there can be too much rain. Then swollen rivers overflow their banks. The waters rush over the river valleys, uprooting trees, sweeping away homes and buildings, destroying crops, and causing loss of life.

But generally a renewal of life follows rain. Wherever there is plenty of rain during the growing season, life of all kinds is abundant. Where little or no rain falls, the land is barren and there are few forms of life. Great deserts form when such a lack of water continues.

Rain is always falling somewhere on the earth. The record for the entire surface of the earth, according to computations at thousands of widely scattered weather

---

[247]"Rain," The World Book Encyclopedia, XVI (1964), p. 122.

stations, is 45,000 thunderstorms a day, or 1,800 an hour. The island of Java is the world's most thunderous spot. It has no fewer than 223 storm days a year.

Fish[248]

There are more than thirty thousand kinds of fish. They live in the oceans, lakes and streams from the equator to the polar seas, and from elevations of more than fifteen thousand feet above the sea to depths at least that far below sea level. There are few waters that do not contain at least one kind of fish.

Fossils show that this has been true for many millions of years. Fish have a great variety of forms and habits because they live in many different places. The appearance, body structure, and life ways fit each kind of fish to the particular place where it lives. In the open sea, for examples, most fish are hard to see because they are colored metalic blue-green above and silvery below. They are almost perfectly stream-lined. There are two reasons for this. In such open waters the kinds of fish that are eaten have no place in which to hide. They must swim swiftly to avoid being eaten. The kinds that eat other fish must also swim swiftly in order to catch their prey.

Fishes that live near the bottom of bodies of water are colored like the bottom. Many of them are eel-shaped so that they can slip into burrows or cracks. Others cannot move fast because they have developed a

---

[248]"Fish," The World Book Encyclopedia, VII (1964), p. 139.

bony armor or strong spines. This covering is their protection. Fish that live in seaweeds are often marvelously camouflaged. They may even resemble the seaweeds in shape and movement, as well as in color. Many fish that live in the dark, deep sea carry their own lights.

Birds[249]

The bird is an animal with feathers. Birds live in all parts of the world. Some make their homes in the cold places near the North Pole. Others live in the hot, green jungles of South America and Africa. Some birds live in fields and some in the mountains. Others stay near water. The colors of some birds brighten the places where they live. The feathers of other birds are dull and help to hide them. All birds have wings, but some, such as the ostrich, cannot fly.

Birds have many ways of life. Birds called swifts spend most of their waking hours flying. The penquin waddles on the ice and swims in the ocean, but cannot fly. Many birds migrate, or travel long distances, at certain seasons. For this reason, many kinds of birds you see in the summer leave for the winter. They return the next summer to court their mates and build their nests.

The graceful flight of birds and their beautiful colors and sweet songs have inspired artists, poets, and musicians. Inventors studied birds for hundreds of years before man, too learned to fly in gliders and airplanes.

Every bird hatches from an egg, and has two legs and a bill, or beak. Birds have built-in "air-conditioning." That is, some of their bones are hollow and their bodies have air sacs, or pockets. The hollow bones also make birds

---

[249]"Birds," The World Book Encyclopedia, II (1964), p. 250.

lighter so they can fly easily.

Many birds are valuable to man. Chickens and other poultry provide meat and eggs for food. Birds help the farmer by eating insects that attack his crops. A few birds eat the farmer's grain and fruit. But the good that birds do, more than makes up for the damage they cause.

Flowers[250]

The flowers, or blossoms, of plants and trees bloom almost everywhere on earth. Some flowers grow on high mountains at the edges of snow fields and glaciers. Others live in the shallow parts of oceans. Even hot, dry deserts have many bright blossoms during and after the rainy season. Most flowers need soil in which to grow, but some can grow on tree brances. Others float on lakes and streams. About the only places flowers do not grow are in the ice-covered parts of the Arctic and Antarctic and in the open seas.

The word "flower" may mean either (1) the blossom or (2) the whole plant. Botanists, scientists who study plants, use the word flower to mean only the blossom of a plant. They call the whole plant - blossom, stem, leaves, and roots- a flowering plant. Any plant that produces some sort of flower, even a tiny, colorless one, is a flowering plant. Grasses, roses, lillies, apple trees, and oaks are all flowering plants.

Flowers are the reproductive parts of flowering plants. The plants could not develop seeds and reproduce without them.

Man depends completely on flowers and flowering plants for his food. Flowering plants include almost all

---

[250]"Flowers," The World Book Encyclopedia, VII (1964), p. 234.

of our grains, fruits, and vegetables. Even the animals that we use for food, such as cattle, hogs, and sheep live on flowering plants.

Stars[251]

The stars are suns. Some of the stars are bigger than our own sun, and some are smaller and fainter. Our sun seems so much brighter and larger than all other stars simply because it is much nearer to us than any of the rest. Our sun in only about 93 million miles away. Yet it is far enough away that a rocket from earth traveling 25 thousand miles an hour, or seven miles a second, would take 152 days and eight hours, or about five months, to reach the sun. But the nearest star except for our sun is so far away that our seven miles a second would take almost 115 thousand years to reach it. Even this star is a close neighbor, as stars go. Others are millions of times farther away.

We see two kinds of star-like objects in the sky. One is the stars themselves. The other is the sun's "family of plants" that circle the sun as the earth does.

Since very early times man has looked up at the stars and wondered about these diamond-like points of light that shimmer above him. Some ancient carvings show men who lived 5,000 years ago studied the heavens.

But ancient men probably had no idea what the stars are really like. They did not dream that the stars are other suns, far out in space. They thought that stars made the outlines of animals or persons in the sky, and they called

---

[251]"Stars," The World Book Encyclopedia, XVII (1964), p. 660.

these shapes constellations. The ancient Greeks thought that one group of stars looked like a winged horse, which they named Pegasus. Other groups of stars were named after other animals or persons, and these animals and persons became part of the legends and folk tales that have come down to us through thousands of years.

Bees[252]

The bee is an insect that lives in almost every part of the world except near the North and South Poles. There are ten thousand species of bees, but only honeybees make honey and wax that man can use. Bees are the only insects that produce food eaten by man. We use the wax from the nests of bees in making such products as candles and lipsticks. We use their honey in cooking and as a sweet spread on bread.

When bees fly from flower to flower, they help both man and the blossoms they visit. Many fruits and vegetables would die if bees did not help fertilize flowers. Bees gather nectar and pollen from flowers. They make honey from the nectar and use the honey and pollen as food.

Some people are afraid of bees because they sting. But bees do not sting unless they are fightened or hurt. Like most other insects, bees have three pairs of legs and four wings. A bee has a special stomach, called a honey stomach, in which it carried nectar to the nest.

Honeybees are social insects. They live and work together in large groups. They form a colony, or group, of thousands of bees. A single honeybee can live alone only a few days, but the colony can go on living for many years.

---

[252]"Bees," The World Book Encyclopedia, II (1964), p. 154.

One worker can do little by itself, but the many thousands of workers in a colony, working as a group, can do many things. They fly into the fields and woods to gather food and water. They build their own home in a box, a hollow tree, or a bee hive. They store honey and pollen and eat it in winter, just as squirrels eat the nuts they store. Honeybees even air-condition their hive to keep it warm or cool.

APPENDIX B

CONSTRUCTION OF THE MASTER TAPES

Master Tape I

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
1	PS	3	Spon-Tel	Physical Size	Big
2	DR	1	Spon-Tel	Dialect Region	Michigan
3	DR	7	Spon-Tel	Dialect Region	East
4	E	3	Prep-Nor	Education	-High School
5	DR	2	Prep-Nor	Dialect Region	Michigan
6	A	14	Prep-Nor	Age	60-70
7	E	7	Prep-Nor	Education	High School
8	DR	13	Spon-Nor	Dialect Region	South
9	EG	2	Spon-Tel	Ethnic Group	Caucasian
10	PS	7	Prep-Nor	Physical Size	Small
11	EG	1	Prep-Nor	Ethnic Group	Caucasian
12	A	8	Prep-Nor	Age	40-50
13	DR	2	Spon-Nor	Dialect Region	Michigan
14	EG	3	Spon-Nor	Ethnic Group	Caucasian
15	PS	7	Prep-Tel	Physical Size	Small
16	DR	8	Prep-Nor	Dialect Region	East
17	PS	8	Spon-Tel	Physical Size	Small
18	EG	8	Spon-Tel	Ethnic Group	Negro
19	A	7	Spon-Tel	Age	40-50
20	DR	8	Spon-Nor	Dialect Region	East
21	PS	3	Spon-Nor	Physical Size	Big
22	E	8	Prep-Nor	Education	High School

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
23	PS	2	Prep-Nor	Physical Size	Big
24	EG	1	Prep-Tel	Ethnic Group	Caucasian
25	E	15	Prep-Nor	Education	College
26	PS	7	Spon-Nor	Physical Size	Small
27	E	7	Spon-Nor	Education	High School
28	E	1	Spon-Tel	Education	-High School
29	DR	2	Prep-Tel	Dialect Region	Michigan
30	E	14	Spon-Tel	Education	College
31	EG	9	Spon-Nor	Ethnic Group	Negro
32	DR	8	Prep-Tel	Dialect Region	East
33	E	15	Prep-Tel	Education	College
34	DR	14	Prep-Tel	Dialect Region	South
35	A	13	Spon-Tel	Age	60-70
36	S	9	Spon-Nor	Sex	Female
37	S	7	Prep-Nor	Sex	Female
38	EG	8	Prep-Tel	Ethnic Group	Negro
39	A	2	Spon-Nor	Age	20-30
40	S	3	Prep-Nor	Sex	Male
41	A	13	Spon-Nor	Age	70-70
42	E	2	Prep-Tel	Education	-High School
43	DR	15	Spon-Tel	Dialect Region	South
44	S	9	Prep-Tel	Sex	Female
45	S	2	Prep-Tel	Sex	Male

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
46	E	3	Spon-Nor	Education	-High School
47	A	1	Prep-Nor	Age	20-30
48	EG	8	Prep-Nor	Ethnic Group	Negro
49	A	2	Spon-Tel	Age	20-30
50	A	14	Prep-Tel	Age	60-70
51	S	8	Spon-Tel	Sex	Female
52	A	8	Spon-Nor	Age	40-50
53	S	1	Spon-Nor	Sex	Male
54	A	1	Prep-Tel	Age	20-30
55	A	8	Prep-Tel	Age	40-50
56	S	2	Spon-Nor	Sex	Male
57	DR	15	Prep-Nor	Dialect Region	South
58	PS	2	Prep-Tel	Physical Size	Big
59	E	7	Prep-Tel	Education	High School
60	E	13	Spon-Nor	Education	College

Master Tape II

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
1	DR	9	Spon-Tel	Dialect Region	East
2	E	7	Spon-Tel	Education	High School
3	A	3	Prep-Nor	Age	20-30
4	PS	8	Prep-Tel	Physical Size	Small
5	DR	7	Spon-Nor	Dialect Region	East
6	PS	1	Spon-Tel	Physical Size	Big
7	S	2	Spon-Tel	Sex	Male
8	A	7	Prep-Nor	Age	40-50
9	EG	3	Spon-Tel	Ethnic Group	Caucasian
10	E	2	Prep-Nor	Education	-High School
11	EG	8	Spon-Nor	Ethnic Group	Negro
12	PS	9	Prep-Nor	Physical Size	Small
13	DR	1	Prep-Nor	Dialect Region	Michigan
14	DR	7	Prep-Tel	Dialect Region	East
15	E	14	Prep-Tel	Education	College
16	A	1	Spon-Tel	Age	20-30
17	S	9	Spon-Tel	Sex	Female
18	E	3	Spon-Tel	Education	-High School
19	DR	15	Spon-Nor	Dialect Region	South
20	PS	3	Prep-Tel	Physical Size	Big
21	PS	3	Prep-Nor	Physical Size	Big
22	EG	9	Prep-Tel	Ethnic Group	Negro

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
23	E	15	Spon-Tel	Education	College
24	S	7	Spon-Nor	Sex	Female
25	A	15	Spon-Nor	Age	60-70
26	S	9	Prep-Nor	Sex	Female
27	S	8	Prep-Tel	Sex	Female
28	EG	9	Prep-Nor	Ethnic Group	Negro
29	PS	1	Spon-Nor	Physical Size	Big
30	A	9	Spon-Nor	Age	40-50
31	DR	14	Spon-Tel	Dialect Region	South
32	S	1	Prep-Nor	Sex	Male
33	E	13	Prep-Nor	Education	College
34	E	14	Spon-Nor	Education	College
35	A	2	Prep-Tel	Age	20-30
36	A	1	Spon-Nor	Age	20-30
37	DR	1	Spon-Nor	Dialect Region	Michigan
38	EG	1	Spon-Nor	Ethnic Group	Caucasian
39	E	8	Prep-Nor	Education	High School
40	DR	13	Prep-Nor	Dialect Region	South
41	A	8	Spon-Tel	Age	40-50
42	S	1	Prep-Tel	Sex	Male
43	E	3	Prep-Tel	Education	High School
44	A	7	Prep-Tel	Age	40-50
45	DR	1	Prep-Tel	Dialect Region	Michigan

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
46	A	13	Prep-Nor	Age	60-70
47	S	3	Spon-Nor	Sex	Male
48	E	1	Spon-Nor	Education	-High School
49	DR	9	Prep-Nor	Dialect Region	East
50	DR	3	Spon-Tel	Dialect Region	Michigan
51	EG	2	Prep-Nor	Ethnic Group	Caucasian
52	A	15	Spon-Tel	Age	60-70
53	PS	7	Spon-Tel	Physical Size	Small
54	EG	7	Spon-Tel	Ethnic Group	Negro
55	E	8	Spon-Nor	Education	High School
56	EG	2	Prep-Tel	Ethnic Group	Caucasian
57	DR	15	Prep-Tel	Dialect Region	South
58	A	15	Prep-Tel	Age	60-70
59	E	8	Prep-Tel	Education	High School
60	PS	8	Spon-Nor	Physical Size	Small

Master Tape III

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
1	PS	8	Prep-Nor	Physical Size	Small
2	DR	3	Spon-Nor	Dialect Region	Michigan
3	EG	7	Prep-Tel	Ethnic Group	Negro
4	A	9	Prep-Nor	Age	40-50
5	E	9	Spon-Nor	Education	High School
6	PS	9	Spon-Tel	Physical Size	Small
7	DR	2	Spon-Tel	Dialect Region	Michigan
8	E	1	Prep-Tel	Education	-High School
9	PS	1	Prep-Nor	Physical Size	Big
10	E	13	Prep-Tel	Education	College
11	E	9	Prep-Tel	Education	High School
12	A	2	Prep-Nor	Age	20-30
13	A	9	Spon-Tel	Age	40-50
14	A	14	Spon-Nor	Age	60-70
15	S	7	Prep-Tel	Sex	Female
16	EG	2	Spon-Nor	Ethnic Group	Caucasian
17	EG	3	Prep-Tel	Ethnic Group	Michigan
18	DR	3	Prep-Tel	Dialect Region	Michigan
19	S	3	Prep-Tel	Sex	Male
20	DR	13	Spon-Tel	Dialect Region	South
21	A	13	Prep-Tel	Age	60-70
22	S	8	Prep-Nor	Sex	Female

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
23	DR	7	Prep-Nor	Dialect Region	East
24	E	1	Prep-Nor	Education	-High School
25	A	14	Spon-Tel	Age	60-70
26	A	3	Prep-Tel	Age	20-30
27	EG	9	Spon-Tel	Ethnic Group	Negro
28	S	3	Spon-Tel	Sex	Male
29	PS	2	Spon-Tel	Physical Size	Big
30	S	2	Prep-Nor	Sex	Male
31	DR	9	Prep-Tel	Dialect Region	East
32	DR	3	Prep-Nor	Dialect Region	Michigan
33	EG	3	Prep-Nor	Ethnic Group	Caucasian
34	PS	9	Spon-Nor	Physical Size	Small
35	DR	13	Prep-Tel	Dialect Region	South
36	PS	9	Prep-Tel	Physical Size	Small
37	PS	1	Prep-Tel	Physical Size	Big
38	E	9	Spon-Tel	Education	High School
39	DR	9	Spon-Nor	Dialect Region	East
40	EG	7	Prep-Nor	Ethnic Group	Negro
41	A	7	Spon-Nor	Age	40-50
42	E	14	Prep-Nor	Education	College
43	A	9	Prep-Tel	Age	40-50
44	EG	7	Spon-Nor	Ethnic Group	Negro
45	E	2	Spon-Tel	Education	-High School

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
46	EG	1	Spon-Tel	Ethnic Group	Caucasian
47	A	15	Prep-Nor	Age	60-70
48	E	9	Prep-Nor	Education	High School
49	DR	14	Prep-Nor	Dialect Region	South
50	S	7	Spon-Tel	Sex	Female
51	E	15	Spon-Nor	Education	College
52	DR	14	Spon-Nor	Dialect Region	South
53	S	1	Spon-Nor	Sex	Male
54	DR	8	Spon-Tel	Dialect Region	East
55	PS	2	Spon-Nor	Physical Size	Big
56	A	3	Spon-Nor	Age	20-30
57	E	2	Spon-Nor	Education	-High School
58	S	8	Spon-Nor	Sex	Female
59	A	3	Spon-Tel	Age	20-30
60	E	13	Spon-Tel	Education	College

APPENDIX C

TEXT OF THE TRAINING PROGRAM

AND PRACTICE TEST

My name is Pat Nerbonne. I am a doctoral student in the Department of Speech and am presently doing my dissertation--which is why I am here with you today. What we will be doing should be beneficial to both of us. For me, you will serve as subjects and furnish the data for the experiment I am doing. For you, I hope to be able to furnish a good start toward your becoming critical listeners. This is necessary before one can improve his voice and articulation, and of course, this is what Speech 108 is all about.

What I am trying to find out is whether or not persons, such as yourselves, can, after listening to someone talk, identify some particular characteristic about him. Specifically, I want to know if you can tell me: (1) what sex a person is; (2) his age; (3) what ethnic group he belongs to; (4) the extent of his formal education; (5) something about his physical size, that is, whether he is "big" or "small;" and (6) what part of the country he comes from--the South, the East, or right here in Michigan. There are some other factors involved too that might change the extent to which you will be able to make these identifications. These have to do with the kind of speech you will be hearing. Specifically, you will hear four kinds of speech. The difference between two of these is due to the way they were recorded. One was recorded in a standard way, using a microphone and tape recorder. The other, however, was recorded from a telephone. The speech from these two kinds of

recordings will sound different to you. The telephone speech will probably seem tinny and thin compared to the speech recorded in the usual way. The difference between the other two kinds of speech you will hear is due to the fact that one is oral reading while the other is spontaneous, off the cuff speech. Oral reading is usually smoother and less jerky than off the cuff speech, but it is not as expressive.

The fact that you will be hearing speech under these various conditions will not make your job any different. Your task will be the same for every speaker you hear--to indicate what sex he or she is, what age group he belongs to, and so on. Your job will be made easier by the fact that you will only judge each speaker you hear on one thing. This is indicated on the practice answer forms you have. On the first page you can see under the column labeled "characteristic" that you are being asked to evaluate only what sex each speaker is. This is the way all of the answer sheets are except the last few pages. On the last few pages, the "characteristic" column is all mixed up. But, even on these pages, you will only judge each speaker on one characteristic--the one listed for him or her.

Now, let's get started with a little practice. Refer to page one of your answer sheet. Listen to the first speaker and then circle the appropriate sex, that is, "male" or "female," under the "dimension" column on the right hand side of your answer sheet.

Five, ten, or 15 sec sample of sex speaker 4 (male), spontaneous normal condition.

That was a male speaker. How many of you circled "male?" How many circled "female?" The main difference between male and female speakers, of course, is the pitch of the voice. Listen to the second speaker and circle what you think is the appropriate sex.

Five, ten, or 15 sec sample of sex speaker 10 (female), spontaneous normal condition.

That speaker was a female. How many circled "male?" Besides the pitch of the voice, there are other ways to differentiate between male and female speakers. It is usually easier to understand males, for example. Their speech is more intelligible. Males also use a longer syllable duration. This makes it seem as though females talk faster than males. Listen to the next speaker now and circle what you think is the appropriate sex.

Five, ten, or 15 sec sample of sex speaker 5 (male), prepared normal condition.

That speaker was a male. How many circled "female?" Okay, now let's listen to the next four speakers. Speakers four through seven on your answer sheet. In each case, circle what you think is the appropriate sex.

Five, ten, or 15 sec sample of sex speaker 4 (male), prepared normal condition; sex speaker 11 (female), prepared normal condition; sex speaker 10 (female), spontaneous telephone condition; and sex speaker 5 (male), prepared telephone condition.

Okay, I'll read the answers. I'll pause after each answer and I would like those of you who circled the wrong sex to raise your hands. This is just to give me an idea of how you're doing. Speaker number four was a male . . . speaker number five was a female . . . speaker number six was a female . . . . and speaker number seven was a male.

Okay, good. Now let's move on to something a little more difficult. Turn to page two of your answer sheet. This time you will be judging how old the speaker is. As you can see in the "dimension" column on the right hand side of your paper, you will have three choices for each speaker: (1) the age group 20 to 30 years; (2) the age group 40 to 50 years; and (3) the age group 60 to 70 years. Your job will be to circle the age group you think the speaker belongs to. Let's try the first one. Listen and then circle what you feel is the appropriate age group for speaker one.

Five, ten, or 15 sec sample of age speaker 4 (20-30), spontaneous normal condition.

That speaker was between 20 and 30 years of age. How many of you circled one of the other age groups? Listen to

speaker two and circle the age group you feel is appropriate for him.

Five, ten, or 15 sec sample of age speaker 10 (40-50), spontaneous normal condition.

That speaker was between 40 and 50. How many got it correct? New let me tell you some things that might help you differentiate between these age groups. First of all, about the older group; those between 60 and 70 years of age. These speakers have been found to talk and read slower than younger speakers and they sometimes have voice breaks. It has also been found that older speakers tend to speak with reduced intensity or loudness; with less force. These things differentiate them from both the 40 to 50 year old speakers and the 20 to 30 year old speakers. Differences between these last two groups are not as obvious. Some of the same differences are present, such as, slower speech and reading for the 40 to 50 year old group, but many of the others, such as, voice quality and reduced intensity do not stand out. Now let's listen to a 60 to 70 year old speaker. Don't bother to mark your answer on this one.

Five, ten, or 15 sec sample of age speaker 16 (60-70), spontaneous normal condition.

Okay, now let's listen to the next three speakers; speakers four, five, and six. For each one, circle what you feel is the appropriate age group.

Five, ten, or 15 sec sample of age speaker 11 (40-50), prepared normal condition; age speaker 17 (60-70), spontaneous normal condition; and age speaker 5 (20-30), prepared normal condition.

I'll read the answers. Raise your hand if you have an answer different than what I read. Speaker number four was 40 to 50 years of age . . . speaker number five was 60 to 70 years of age . . . and speaker number six was 20 to 30 years of age . . . Okay, good. Now let's try some more. We'll hear speakers seven through 12. For each one, circle what you feel is the appropriate age group.

Five, ten, or 15 sec sample of age speaker 10 (40-50), spontaneous normal condition; age speaker 4 (20-30), prepared normal condition; age speaker 5 (20-30), prepared normal conditipn; age speaker 16 (60-70), spontaneous telephone condition; age speaker 11 (40-50), spontaneous telephone condition; and age speaker 17 (60-70), prepared telephone condition.

Okay. Did you hear the telephone speech? Let me read the answers. You indicate the ones you missed by raising your hand. Speaker number seven was 40 to 50 years of age . . . speaker number eight was 20 to 30 years of age . . . speaker number nine was 20 to 30 years of age . . . speaker number ten was 60 to 70 years of age . . . speaker number 11 was 40 to 50 years of age . . . and speaker number 12 was 60 to 70 years of age . . . Okay, let's try three more samples of telephone speech. Circle what you feel are the appropriate age groups for speakers 13, 14, and 15.

Five, ten, or 15 sec samples of age speaker 4 (20-30), prepared telephone condition; age speaker 5 (20-30), prepared telephone condition; and age speaker 10 (40-50), spontaneous telephone condition.

Okay, here are the answers. Raise your hand if you missed. Speaker number 13 was 20 to 30 years of age . . . speaker number 14 was 20 to 30 years of age . . . and speaker number 15 was 40 to 50 years of age.

Very good. Now let's talk about the ethnic group characteristic. Turn to page three. Your task here will be to indicate whether you think the speaker is Negro or Caucasian. This is often a very hard differentiation to make. As a matter of fact, research offers us very little to go on in this area. This is especially true for the speakers you will be hearing--Caucasians and Negroes who were born and attended elementary and secondary schools in Michigan. One possible differentiating factor that has been suggested is in voice quality. This difference is due to Negro speakers sometimes articulating some of their vowels in a more open and free manner than Caucasian speakers. It has also been suggested that Caucasians tend to have more nasality in their speech. Another factor that has been suggested is that Negro speakers use a lower pitch than Caucasians. There is also a possibility that some differences in vocal intonation or expression patterns might exist between Caucasian and Negro speakers. This isn't much to go on, but let's give it a try.

Listen to the first three speakers and indicate under the "dimension" column on the right hand side of your answer sheet which ethnic group you feel they belong to--Negro or Caucasian.

Five, ten, or 15 sec sample of ethnic group speaker 4 (Caucasian), spontaneous normal condition; ethnic group speaker 10 (Negro), spontaneous normal condition; and ethnic group speaker 5 (Caucasian), spontaneous normal condition.

All right. Speaker one was Caucasian. Did anyone circle "Negro?" Speaker two was Negro. Raise your hand if you circled "Caucasian." Speaker three was Caucasian. How many missed him? Fine. Let's listen to the next four speakers. Circle what you feel is the appropriate ethnic group for each speaker.

Five, ten, or 15 sec sample of ethnic group speaker 11 (Negro), spontaneous normal condition; ethnic group speaker 10 (Negro), prepared normal condition; ethnic group speaker 11 (Negro), prepared normal condition; and ethnic group speaker 4 (Caucasian), spontaneous telephone condition.

Okay, ready? I'll read the answers. You indicate if you missed by raising your hand. I'll pause after each answer so you'll have time. Speaker number four was Negro . . . speaker number five was Negro . . . speaker number six was Negro . . . and speaker number seven was Caucasian. Fine, Let's try the last three speakers now. These will all be telephone recordings.

Five, ten, or 15 sec sample of ethnic group speaker 10 (Negro), prepared telephone condition; ethnic group speaker 5 (Caucasian), prepared telephone condition; and ethnic group speaker 4 (Caucasian), prepared telephone condition.

All right, here are the answers. Raise your hand again after the ones you missed. Speaker eight was Negro . . . speaker nine was Caucasian . . . and speaker ten was Caucasian.

Okay, turn to page four. The next speaker characteristic we are going to practice is education. Your task in hearing these speakers will be to circle the level of formal education you feel the speaker has. For each speaker, you will have three choices: (1) less than a high school education, indicated on your answer form as "minus H.S.;" (2) a high school education, indicated on your answer form as "H.S.;" and (3) a college education. This characteristic is also sometimes hard to identify. Probably the outstanding speech difference you might notice is grammer. This, of course, is obvious. The less formal education a person has, the more grammatical mistakes you would expect to hear in his speech. Another differentiating factor is often the use of adjectives. Better educated speakers use more adjectives, that is, modifying and qualifying words; or you could say, more complex sentences. You would also expect speakers with little formal education to be less at ease in speaking and probably less fluent in their reading. Vocabulary usage

might also be a give away. Let's try a few speakers. Listen to the first three and circle the education level you feel is appropriate for each one.

Five, ten, or 15 sec sample of education speaker 4 (-H.S.), spontaneous normal condition; education speaker 10 (H.S.), spontaneous normal condition; and education speaker 16 (college), spontaneous normal condition.

Raise your hand if you have the wrong answer for any of the speakers. Speaker number one was less than a high school graduate . . . speaker number two was a high school graduate . . . and speaker number three was a college graduate--what you all hope to be someday . . . Now let's try six more. Again circle what you feel is the appropriate education level for each speaker.

Five, ten, or 15 sec sample of education speaker 11 (H.S.), prepared normal condition; education speaker 17 (college), prepared normal condition; education speaker 5 (-H.S.), prepared normal condition; education speaker 4 (-H.S.), prepared normal condition; education speaker 16 (college), prepared normal condition; and education speaker 10 (H.S.), prepared normal condition.

Okay, raise your hand if you have the wrong answer. Speaker number four was a high school graduate . . . speaker number five was a college graduate . . . speaker number six was less than a high school graduate . . . speaker number seven was also less than a high school graduate . . . speaker number eight was a college graduate . . . and speaker number

nine was a high school graduate. Okay, good. Let's listen to four more. Remember to circle your answers.

Five, ten or 15 sec sample of education speaker 16 (college), spontaneous telephone condition; education speaker 11 (H.S.), spontaneous telephone condition; education speaker 5 (-H.S.), spontaneous telephone condition; and education speaker 17 (college), prepared telephone condition.

Okay, let's see how you did. Speaker ten was a college graduate . . . speaker 11 was a high school graduate . . . speaker 12 was less than a high school graduate . . . and speaker 13 was a college graduate.

Now, two more characteristics to practice. Our next one is physical size. Turn to page five. As you can see by your answer sheet, your job on this characteristic will be to indicate whether you think the speaker is "big" or "small." Let me define these two terms a little more for you. By "big" I mean someone about six feet, one inch, weighing approximately 205 pounds. The small speakers average about five feet five and weigh about 120 pounds. So, we're talking about two opposite extremes.

There is very little research in this area. However, I think we all have some expectations for these speakers. In general, we tend to expect a big, booming voice from the large fellows and perhaps a thin, weak voice from the little guys. This is, of course, somewhat exaggerated and, in some cases, not very accurate. Let's listen to a few and see how you do. Circle your answers as before.

Five, ten, or 15 sec sample of physical size speaker 4 (big), spontaneous normal condition; physical size speaker 10 (small), spontaneous normal condition; physical size speaker 5 (big), spontaneous normal condition; and physical size speaker 11 (small), spontaneous normal condition.

Okay, here are your answers. Raise your hand if you were incorrect. Speaker number one was big . . . speaker number two was small . . . speaker number three was big . . . and speaker number four was small . . . All right, let's try five more. Be sure to circle your answers.

Five, ten, or 15 sec sample of physical size speaker 4 (big), prepared normal condition; physical size speaker 10 (small), prepared normal condition; physical size speaker 5 (big), spontaneous telephone condition; physical size speaker 11 (small), spontaneous telephone condition; and physical size speaker 10 (small), spontaneous telephone condition.

Now, let's see how you did. Raise your hand on the ones you missed. Speaker number five was big . . . speaker number six was small . . . speaker number seven was big . . . speaker number eight was small . . . and speaker number nine was small . . . Okay, very good. This characteristic is not as easy as it sounds at first. Let's try three more.

Five, ten, or 15 sec sample of physical size speaker 4 (big), spontaneous telephone condition; physical size speaker 11 (small), prepared telephone condition; and physical size speaker 5 (big), prepared telephone condition.

All right. Let's see how you did on this group. Raise your hand again on the ones you missed. Speaker ten was big . . . speaker 11 was small . . . and speaker 12 was big.

All right, fine. Now for the last characteristic we will practice. Turn to page six. Your job this time will by to indicate what part of the country you think the speaker is from. As you can see on your answer sheet, you will have three choices for each speaker: (1) the East; (2) the South; and (3) Michigan. What you will be listening for, of course, will be dialects. That's why we call this characteristic "dialect region." We expect a person from the South to speak with a Southern dialect. Likewise, we expect someone from the East to use an Eastern dialect. We expect the General American dialect from a speaker from Michigan. This type of speech is what you've been hearing from me for the past 35 minutes. The Southern and Eastern dialects are different from my speech. For example, let's consider the "r" sound as it occurs in the final position of words such as "far" and "poor." Eastern and Southern speakers seem to drop these "r's" and say something resembling [fɑɜ] and [pɔɜ]. The same thing happens with other words such as "barn," "form," and "third." In Eastern and Southern speech, these often come out as [bɑɜn], [fɔɜm], and [θɜd]. Another characteristic of Eastern speech is their tendency to broaden or flatten some vowel sounds. An example of this is in the

words "foreign" and "orange," which I just said in my usual manner. Some Easterners would say [fɑrən] and [ɑrəndʒ]. This broadening of vowels also occurs in Eastern speech in such words as "ask" and "dance." Someone from the East might say [ɑsk] and [dɑns]. These examples are somewhat exaggerated but they'll give you the general idea.

In addition to their use of the "r" sound, Southern speakers can often be identified by the way they say the sound "i." They often seem to broaden this sound, changing "like" into [lɑk] and "white" into [wɑt]. Another thing they sometimes do is insert the [j] sound before the [u] sound in words like "duty" and "tune." These then become [djutɪ] and [tjun]. In addition, we are all familiar with the Southern drawl. This makes it seem as though Southern speakers talk slower than people from the rest of the country. On the other hand, the clipped, staccato type speech that some Eastern speakers use makes it seem as though they talk very fast. Let's listen to a few speakers and see how you do.

Five, ten, or 15 sec sample of dialect region speaker 4 (Michigan), spontaneous normal condition; dialect region speaker 16 (South), spontaneous normal condition; and dialect region speaker 10 (East), spontaneous normal condition.

Okay, here are the answers for the first three speakers. Raise your hand if you circled an answer different from what I read for any speaker. Speaker one was from Michigan . . . speaker two was from the South . . . and

speaker three was from the East . . . All right, let's listen to three more; speakers four, five, and six.

Five, ten, or 15 sec sample of dialect region speaker 17 (South), prepared normal condition; dialect region speaker 11 (East), prepared normal condition; and dialect region speaker 16 (South), spontaneous telephone condition.

Raise your hand again if you missed any as I read the answers. Speaker four was from the South . . . speaker five was from the East . . . and speaker six was from the South . . . Okay, good. Let's listen to three more.

Five, ten, or 15 sec sample of dialect region speaker 10 (East), prepared telephone condition; dialect region speaker 11 (East), prepared telephone condition; and dialect region speaker 17 (South), prepared telephone condition.

Okay, raise your hand if you missed any. Speaker seven was from the East . . . speaker eight was from the East . . . and speaker nine was from the South.

Very good. Now turn to page seven. As you can see, there are fifteen speakers on this page and the characteristic to be judged is different for each one. Your job will be the same as before though. Just circle the dimension on the right that you feel is appropriate for each speaker according to the characteristic he or she is to be evaluated on. For example, you can see that speaker one is going to be judged on ethnic group. Just as before, you circle either "Caucasian" or

"Negro." Speaker two will be judged on dialect region. You will circle "South," "East," or "Michigan." Okay, ready? Here we go.

Speaker Number	Identification Char.	#	Cond.	Characteristic	Dimension
1	EG	12	Spon-Nor	Ethnic Group	Negro
2	DR	18	Spon-Tel	Dialect Region	South
3	E	6	Spon-Nor	Education	-High School
4	E	18	Spon-Tel	Education	College
5	A	6	Spon-Nor	Age	20-30
6	A	12	Prep-Nor	Age	40-50
7	PS	12	Spon-Nor	Physical Size	Small
8	DR	12	Prep-Tel	Dialect Region	East
9	A	18	Spon-Tel	Age	60-70
10	EG	6	Prep-Tel	Ethnic Group	Caucasian
11	S	6	Prep-Tel	Sex	Male
12	E	12	Spon-Nor	Education	High School
13	S	12	Spon-Nor	Sex	Female
14	PS	6	Spon-Nor	Physical Size	Big
15	DR	6	Spon-Tel	Dialect Region	Michigan

APPENDIX D

INSTRUCTIONS TO SUBJECTS

MASTER TAPE I

Okay, now turn to page eight. Listen carefully to the following instructions.

You are being asked to make judgments about various characteristics of speakers. There are six characteristics in all and you will make a judgment about just one for each speaker you hear. Please refer to your answer forms. As you can see, there are three categories across the top of the page: at the left is "Speaker Number;" in the center, "Characteristic;" and at the right, "Dimensions." Each speaker you hear will be designated by a number in the left-hand column. The characteristic you will be evaluating or identifying for each speaker is listed in the center column. In the right-hand column are listed the various dimensions of the characteristic you are to evaluate for each speaker. You are to circle only one of these dimensions for each speaker. For example, the first speaker you will hear will be speaker number one. The characteristic you will be evaluating about him is Physical Size as indicated in the center column. In the right-hand column are the dimensions of this characteristic; in this case "big" and "small." You are to circle just one of the dimensions. As you can see from your answer form, for the second speaker (speaker number two) you will be evaluating Dialect Region and the dimensions for this characteristic are again listed in the right-hand column. You will circle only one just as you will have done for speaker number one.

As indicated by your answer form, this procedure will continue for 60 speakers.

Are there any questions at this point...?

The six characteristics you will be evaluating for the speakers are: (1) Sex; (2) Age; (3) Ethnic Group; (4) Education Level; (5) Physical Size; and (6) Dialect Region of the country.

As we have already seen, there are three dimensions for the last characteristic, Dialect Region. These are, the South; the East; and Michigan. There are two dimensions for the Sex characteristic; male and female. This is illustrated by speaker number 37 on the second page of your answer form. For the Age characteristic, there are three dimensions; the age group 20 to 30 years, the age group 40 to 50 years, and the age group 60 to 70 years. For each speaker for which a judgment on the Age characteristic is requested, for example, speaker number six on your answer form, you are to circle one of these categories or groups. For the Ethnic Group characteristic, there are again two dimensions; Caucasian and Negro. For each speaker for which a judgment on the Ethnic Group characteristic is requested, for example, speaker number nine on your answer form, you are to again circle just one of these two dimensions. For the Education characteristic, there are three dimensions; less than a high school graduate, a high school graduate, and a college graduate. An example for this characteristic is speaker number four on your answer form.

We have already discussed an example of evaluating a speaker on the Physical Size characteristic. As indicated for speaker number one, there will always be a choice of two dimensions when this evaluating is indicated - big or small.

Are there any questions at this point...?

As I indicated before, you will be hearing 60 speakers. However, the speech sample you will hear for each of these 60 speakers will be very short - five seconds. For this reason, you will have to listen closely. Following each speech sample, you will have just ten seconds to circle the dimension you feel is appropriate. Again, this short period of time means you will have to pay close attention. The tape will run continuously during the entire session, even during the time you will be marking your answer form. The tape is arranged so that you will hear a number referring to a speaker, such as "Speaker One;" the five speech sample for that speaker; and then ten seconds of silence during which you will circle the dimension you feel is appropriate for the speaker on the characteristic in question.

Are there any question at this point...?

In summary, your answer forms list the speakers by number and the characteristic to be evaluated for each in the order that you will hear them. You are simply to listen to each speech sample and then circle the one dimension of the

characteristic indicated for that speaker that you feel is appropriate.

Are there any questions before we begin...?

MASTER TAPE II

Okay, now turn to page eight. Listen carefully to the following instructions.

You are being asked to make judgments about various characteristics of speakers. There are six characteristics in all and you will make a judgment about just one for each speaker you hear. Please refer to your answer forms. As you can see, there are three categories across the top of the page: at the left is "Speaker Number;" in the center, "Characteristic;" and at the right, "Dimensions." Each speaker you hear will be designated by a number in the left-hand column. The characteristic you will be evaluating or identifying for each speaker is listed in the center column. In the right-hand column are listed the various dimensions of the characteristic you are to evaluate for each speaker. You are to circle only one of these dimensions for each speaker. For example, the first speaker you will hear will be speaker number one. The characteristic you will be evaluating about him is Dialect Region as indicated in the center column. In the right-hand column are the dimensions of this characteristic; in this case "East," "Michigan," and "South." You are to circle just one of these dimensions. As you can see from your answer form, for the second speaker (speaker number two) you will be evaluating Education Level and the dimensions for this characteristic are again listed in the right-hand column. You will circle only one just as

you will have done for speaker number one. As indicated by your answer form, this procedure will continue for 60 speakers

Are there any questions at this point...?

The six characteristics you will be evaluating for the speakers are: (1) Sex; (2) Age; (3) Ethnic Group; (4) Education Level; (5) Physical Size; and (6) Dialect Region of the country.

As we have already seen, there are three dimensions for the last characteristic, Dialect Region. These are, the East, Michigan, and the South. There are two dimensions for the Sex characteristic; male and female. This is illustrated by speaker number seven on your answer form. For the Age characteristic, there are three dimensions; the age group 20 to 30 years, the age group 40 to 50 years, and the age group 60 to 70 years. For each speaker for which a judgment on the age characteristic is requested, for example, speaker number three on your answer form, you are to circle one of these age categories or groups. For the Ethnic Group characteristic, there are again two dimensions; Caucasian and Negro. For each speaker for which a judgment on the Ethnic Group characteristic is requested, for example, speaker number nine on your answer form, you are to again circle just one of these two dimensions. We have already discussed an example of evaluating a speaker

on the Education Level characteristic. As indicated for speaker two, there will always be a choice of three dimensions when this evaluation is indicated - less than a high school graduate, a high school graduate, and a college graduate. For the Physical Size characteristic, there are two dimensions; big and small. An example for this characteristic is speaker number four on your answer form.

Are there any questions at this point...?

As I indicated before, you will be hearing 60 speakers. However, the speech sample you will hear for each of these 60 speakers will be very short - ten seconds. For this reason, you will have to listen closely. Following each speech sample, you will have another ten seconds to circle the dimension you feel in appropriate. Again, this short period of time means you will have to pay close attention. The tape will run continuously during the entire session, even during the time you will be marking your answer form. The tape is arranged so that you will hear a number referring to a speaker, such as "Speaker One;" the ten second speech sample for that speaker; and then ten seconds of silence during which you will circle the dimension you feel is appropriate for that speaker on the characteristic question.

Are there any questions at this point...?

In summary, your answer forms list the speakers by number and the characteristic to be evaluated for each in

the order that you will hear them. You are simply to listen to each speech sample and then circle the one dimension of the characteristic indicated for that speaker that you feel is appropriate.

Are there any questions before we begin...?

MASTER TAPE III

Okay, now turn to page eight. Listen carefully to the following instructions.

You are being asked to make judgments about various characteristics of speakers. There are six characteristics in all and you will make a judgment about just one for each speaker you hear. Please refer to your answer forms. As you can see, there are three categories across the top of the page: at the left is "Speaker Number;" in the center, "Characteristic;" and at the right, dimensions." Each speaker you hear will be designated by a number in the left-hand column. The characteristic you will be evaluating or identifying for each speaker is listed in the center column. In the right-hand column are listed the various dimensions of the characteristic you are to evaluate for each speaker. You are to circle only one of these dimensions for each speaker. For example, the first speaker you hear will be speaker number one. The characteristic you will evaluating about him is Physical Size as indicated in the center column. In the right-hand column are the dimensions of this characteristic; in the case "big" and "small." You are to circle just one of the dimensions. As you can see from you answer form, for the second speaker (speaker number two) you will be evaluating Dialect Region and the dimensions for this characteristic are again listed in the right-hand column. You will circle only one just as you will have done for

speaker number one. As indicated by your answer form, this procedure will continue for 60 speakers.

Are there any questions at this point...?

The six characteristics you will be evaluating for the speakers are: (1) Sex; (2) Age; (3) Ethnic Group; (4) Education Level; (5) Physical Size; and (6) Dialect Region of the country.

As we have already seen, there are three dimensions for the last characteristic, Dialect Region. These are, the South; the East; and Michigan. There are two dimensions for the Sex characteristic; male and female. This is illustrated by Speaker Number 15 on your answer form. For the Age characteristic, there are three dimensions; the age group 20 to 30 years, the age group 40 to 50 years, and the age group 60 to 70 years. For each speaker for which a judgment on the Age characteristic is requested, for example, speaker number four on your answer form, you are to circle one of these age categories or groups. For the Ethnic Group characteristic, thare are again two dimensions; Caucasian and Negro. For each speaker for which a judgment on the Ethnic Group characteristic is requested, for example, speaker number three on your answer form, you are to again circle just one of these two dimensions. For the Education characteristic, there are three dimensions; less that a high school graduate, a high school graduate and a college graduate. An example for this characteristic is speaker

number five on your answer form. We have already discussed an example of evaluating a speaker on the Physical Size characteristic. As indicated for speaker number one, there will always be a choice of two dimensions when this evaluation is indicated - big or small.

Are there any questions at this point...?

As I indicated before, you will be hearing 60 speakers. However, the speech sample you will hear for each of these 60 speakers will be very short - 15 seconds. For this reason, you will have to listen closely. Following each speech sample, you will have just en seconds to circle the dimension you feel is appropriate. Again, this short period of time means you will have to pay close attention. The tape will run continuously during the entire session, even during the time you will be marking your answer form. The tape is arranged so that you will hear a number referring to a speaker, such as "Speaker One;" the 15 second speech sample for that speaker; and then ten seconds of silence during which you will circle the dimension you feel is appropriate for that speaker on the characteristic in question.

Are there any questions at this point...?

In summary, your answer forms list the speakers by number and the characteristic to be evaluated for each in the order that you will hear them. You are simply to listen to

each speech sample and then circle the one dimension of the characteristic indicated for that speaker that you feel is appropriate.

Are there any questions before we begin...?

APPENDIX E

PRACTICE ANSWER FORM FOR TRAINED GROUPS AND TEST ANSWER FORMS FOR MASTERTAPES I, II, AND III

PRACTICE ANSWER FORM FOR TRAINED GROUPS

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)	
1	Sex	Male	Female
2	Sex	Male	Female
3	Sex	Male	Female
4	Sex	Male	Female
5	Sex	Male	Female
6	Sex	Male	Female
7	Sex	Male	Female

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
1	Age	20-30	40-50	60-70
2	Age	20-30	40-50	60-70
3	Age	20-30	40-50	60-70
4	Age	20-30	40-50	60-70
5	Age	20-30	40-50	60-70
6	Age	20-30	40-50	60-70
7	Age	20-30	40-50	60-70
8	Age	20-30	40-50	60-70
9	Age	20-30	40-50	60-70
10	Age	20-30	40-50	60-70
11	Age	20-30	40-50	60-70
12	Age	20-30	40-50	60-70
13	Age	20-30	40-50	60-70
14	Age	20-30	40-50	60-70
15	Age	20-30	40-50	60-70

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)	
1	Ethnic Group	Negro	Caucasian
2	Ethnic Group	Negro	Caucasian
3	Ethnic Group	Negro	Caucasian
4	Ethnic Group	Negro	Caucasian
5	Ethnic Group	Negro	Caucasian
6	Ethnic Group	Negro	Caucasian
7	Ethnic Group	Negro	Caucasian
8	Ethnic Group	Negro	Caucasian
9	Ethnic Group	Negro	Caucasian
10	Ethnic Group	Negro	Caucasian

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
1	Education	-H.S.	H.S.	College
2	Education	-H.S.	H.S.	College
3	Education	-H.S.	H.S.	College
4	Education	-H.S.	H.S.	College
5	Education	-H.S.	H.S.	College
6	Education	-H.S.	H.S.	College
7	Education	-H.S.	H.S.	College
8	Education	-H.S.	H.S.	College
9	Education	-H.S.	H.S.	College
10	Education	-H.S.	H.S.	College
11	Education	-H.S.	H.S.	College
12	Education	-H.S.	H.S.	College
13	Education	-H.S.	H.S.	College

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)	
1	Physical Size	Big	Small
2	Physical Size	Big	Small
3	Physical Size	Big	Small
4	Physical Size	Big	Small
5	Physical Size	Big	Small
6	Physical Size	Big	Small
7	Physical Size	Big	Small
8	Physical Size	Big	Small
9	Physical Size	Big	Small
10	Physical Size	Big	Small
11	Physical Size	Big	Small
12	Physical Size	Big	Small

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
1	Dialect Region	East	Michigan	South
2	Dialect Region	East	Michigan	South
3	Dialect Region	East	Michigan	South
4	Dialect Region	East	Michigan	South
5	Dialect Region	East	Michigan	South
6	Dialect Region	East	Michigan	South
7	Dialect Region	East	Michigan	South
8	Dialect Region	East	Michigan	South
9	Dialect Region	East	Michigan	South

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
1	Ethnic Group	Negro	Caucasian	
2	Dialect Group	East	Michigan	South
3	Education	-H.S.	H.S.	College
4	Education	-H.S.	H.S.	College
5	Age	20-30	40-50	60-70
6	Age	20-30	40-50	60-70
7	Physical Size	Big	Small	
8	Dialect Region	East	Michigan	South
9	Age	20-30	40-50	60-70
10	Ethnic Group	Negro	Caucasian	
11	Sex	Male	Female	
12	Education	-H.S.	H.S.	College
13	Sex	Male	Female	
14	Physical Size	Big	Small	
15	Dialect Region	East	Michigan	South

MASTER TAPE I ANSWER FORM

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
1	Physical Size	Big	Small	
2	Dialect Region	East	Michigan	South
3	Dialect Region	East	Michigan	South
4	Education	-H.S.	H.S.	College
5	Dialect Region	East	Michigan	South
6	Age	20-30	40-50	60-70
7	Education	-H.S.	H.S.	College
8	Dialect Region	East	Michigan	South
9	Ethnic Group	Negro	Caucasian	
10	Physical Size	Big	Small	
11	Ethnic Group	Negro	Caucasian	
12	Age	20-30	40-50	60-70
13	Dialect Region	East	Michigan	South
14	Ethnic Group	Negro	Caucasian	
15	Physical Size	Big	Small	
16	Dialect Region	East	Michigan	South
17	Physical Size	Big	Small	
18	Ethnic Group	Negro	Caucasian	
19	Age	20-30	40-50	60-70
20	Dialect Region	East	Michigan	South
21	Physical Size	Big	Small	

PLEASE TURN TO NEXT PAGE

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
22	Education	-H.S.	H.S.	College
23	Physical Size	Big	Small	
24	Ethnic Group	Negro	Caucasian	
25	Education	-H.S.	H.S.	College
26	Physical Size	Big	Small	
27	Education	-H.S.	H.S.	College
28	Education	-H.S.	H.S.	College
29	Dialect Region	East	Michigan	South
30	Education	-H.S.	H.S.	College
31	Ethnic Group	Negro	Caucasian	
32	Dialect Region	East	Michigan	South
33	Education	-H.S.	H.S.	College
34	Dialect Region	East	Michigan	South
35	Age	20-30	40-50	60-70
36	Sex	Male	Female	
37	Sex	Male	Female	
38	Ethnic Group	Negro	Caucasian	
39	Age	20-30	40-50	60-70
40	Sex	Male	Female	
41	Age	20-30	40-50	60-70
42	Education	-H.S.	H.S.	College

PLEASE TURN TO NEXT PAGE

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
43	Dialect Region	East	Michigan	South
44	Sex	Male	Female	
45	Sex	Male	Female	
46	Education	-H.S.	H.S.	College
47	Age	20-30	40-50	60-70
48	Ethnic Group	Negro	Caucasian	
49	Age	20-30	40-50	60-70
50	Age	20-30	40-50	60-70
51	Sex	Male	Female	
52	Age	20-30	40-50	60-70
53	Sex	Male	Female	
54	Age	20-30	40-50	60-70
55	Age	20-30	40-50	60-70
56	Sex	Male	Female	
57	Dialect Region	East	Michigan	South
58	Physical Size	Big	Small	
59	Education	-H.S.	H.S.	College
60	Education	-H.S.	H.S.	College

MASTER TAPE II ANSWER FORM Page 8

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
1	Dialect Region	East	Michigan	South
2	Education	-H.S.	H.S.	College
3	Age	20-30	40-50	60-70
4	Physical Size	Big	Small	
5	Dialect Region	East	Michigan	South
6	Physical Size	Big	Small	
7	Sex	Male	Female	
8	Age	20-30	40-50	60-70
9	Ethnic Group	Negro	Caucasian	
10	Education	-H.S.	H.S.	College
11	Ethnic Group	Negro	Caucasian	
12	Physical Size	Big	Small	
13	Dialect Region	East	Michigan	South
14	Dialect Region	East	Michigan	South
15	Education	-H.S.	H.S.	College
16	Age	20-30	40-50	60-70
17	Sex	Male	Female	
18	Education	-H.S.	H.S.	College
19	Dialect Region	East	Michigan	South
20	Physical Size	Big	Small	
21	Physical Size	Big	Small	

PLEASE TURN TO NEXT PAGE

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
22	Ethnic Group	Negro	Caucasian	
23	Education	-H.S.	H.S.	College
24	Sex	Male	Female	
25	Age	20-30	40-50	60-70
26	Sex	Male	Female	
27	Sex	Male	Female	
28	Ethnic Group	Negro	Caucasian	
29	Physical Size	Big	Small	
30	Age	20-30	40-50	60-70
31	Dialect Region	East	Michigan	South
32	Sex	Male	Female	
33	Education	-H.S.	H.S.	College
34	Education	-H.S.	H.S.	College
35	Age	20-30	40-50	60-70
36	Age	20-30	40-50	60-70
37	Dialect Region	East	Michigan	South
38	Ethnic Group	Negro	Caucasian	
39	Education	-H.S.	H.S.	College
40	Dialect Region	East	Michigan	South
41	Age	20-30	40-50	60-70
42	Sex	Male	Female	

PLEASE TURN TO NEXT PAGE

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
43	Education	-H.S.	H.S.	College
44	Age	20-30	40-50	60-70
45	Dialect Region	East	Michigan	South
46	Age	20-30	40-50	60-70
47	Sex	Male	Female	
48	Education	-H.S.	H.S.	College
49	Dialect Region	East	Michigan	South
50	Dialect Region	East	Michigan	South
51	Ethnic Group	Negro	Caucasian	
52	Age	20-30	40-50	60-70
53	Physical Size	Big	Small	
54	Ethnic Group	Negro	Caucasian	
55	Education	-H.S.	H.S.	College
56	Ethnic Group	Negro	Caucasian	
57	Dialect Region	East	Michigan	South
58	Age	20-30	40-50	60-70
59	Education	-H.S.	H.S.	College
60	Physical Size	Big	Small	

MASTER TAPE III ANSWER FORM Page 8

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
1	Physical Size	Big	Small	
2	Dialect Region	East	Michigan	Small
3	Ethnic Group	Negro	Caucasian	
4	Age	20-30	40-50	60-70
5	Education	-H.S.	H.S.	College
6	Physical Size	Big	Small	
7	Dialect Region	East	Michigan	South
8	Education	-H.S.	H.S.	College
9	Physical Size	Big	Small	
10	Education	-H.S.	H.S.	College
11	Education	-H.S.	H.S.	College
12	Age	20-30	40-50	60-70
13	Age	20-30	40-50	60-70
14	Age	20-30	40-50	60-70
15	Sex	Male	Female	
16	Ethnic Group	Negro	Caucasian	
17	Ethnic Group	Negro	Caucasian	
18	Dialect Region	East	Michigan	South
19	Sex	Male	Female	
20	Dialect Region	East	Michigan	South
21	Age	20-30	40-50	60-70

PLEASE TURN TO NEXT PAGE

Speaker Number	Characteristic	Dimensions (circle only one (1) for each speaker)		
22	Sex	Male	Female	
23	Dialect Region	East	Michigan	South
24	Education	-H.S.	H.S.	College
25	Age	20-30	40-50	60-70
26	Age	20-30	40-50	60-70
27	Ethnic Group	Negro	Caucasian	
28	Sex	Male	Female	
29	Physical Size	Big	Small	
30	Sex	Male	Female	
31	Dialect Region	East	Michigan	South
32	Dialect Region	East	Michigan	South
33	Ethnic Group	Negro	Caucasian	
34	Physical Size	Big	Small	
35	Dialect Region	East	Michigan	South
36	Physical Size	Big	Small	
37	Physical Size	Big	Small	
38	Education	-H.S.	H.S.	College
39	Dialect Region	East	Michigan	South
40	Ethnic Group	Negro	Caucasian	
41	Age	20-30	40-50	60-70
42	Education	-H.S.	H.S.	College

PLEASE TURN TO NEXT PAGE

Speaker Number	Characteristic	Dimensions (circle only (1) for each speaker)		
43	Age	20-30	40-50	60-70
44	Ethnic Group	Negro	Caucasian	
45	Education	-H.S.	H.S.	College
46	Ethnic Group	Negro	Caucasian	
47	Age	20-30	40-50	60-70
48	Education	-H.S.	H.S.	College
49	Dialect Region	East	Michigan	South
50	Sex	Male	Female	
51	Education	-H.S.	H.S.	College
52	Dialect Region	East	Michigan	South
53	Sex	Male	Female	
54	Dialect Region	East	Michigan	South
55	Physical Size	Big	Small	
56	Age	20-30	40-50	60-70
57	Education	-H.S.	H.S.	College
58	Sex	Male	Female	
59	Age	20-30	40-50	60-70
60	Education	-H.S.	H.S.	College

APPENDIX F

PROPORTION CORRECT ON EACH SPEAKER CHARACTERISTIC OVER ALL TRAINING, SPEECH, AND DURATION FACTORS FOR THE TEST AND RETEST CONDITIONS

Subject	Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_1	1.00	1.00	.75	.67	.88	.88	.50	.50	.88	.75	.59	.59
S_2	1.00	1.00	.67	.84	.88	.75	.50	.67	.50	.75	.50	.67
S_3	1.00	.88	.25	.42	.75	.88	.42	.33	.50	.62	.42	.75
S_4	1.00	1.00	.67	.67	.75	.88	.67	.42	.62	.62	.92	.67
S_5	1.00	.100	.50	.50	.75	.88	.59	.59	.50	.50	.67	.67
S_6	1.00	1.00	.59	.50	.88	.75	.75	.67	.75	.62	.67	.67
S_7	1.00	1.00	.59	.75	.75	.75	.75	.75	.50	.75	.67	.75
S_8	1.00	1.00	.50	.50	.88	.88	.75	.59	.75	.62	.59	.50
S_9	1.00	1.00	.34	.50	.62	.88	.34	.59	.75	.50	.34	.34
S_{10}	1.00	1.00	.59	.50	.75	.75	.59	.67	.50	.60	.67	.50
S_{11}	1.00	1.00	.50	.50	.75	.88	.34	.42	.62	.62	.59	.42
S_{12}	1.00	1.00	.50	.42	.75	.75	.08	.42	.75	.75	.75	.59
S_{13}	1.00	.88	.59	.67	.88	.88	.67	.59	.62	.50	.84	.67
S_{14}	1.00	1.00	.67	.67	.62	.62	.42	.42	.50	.50	.67	.59
S_{15}	1.00	1.00	.59	.67	.50	.75	.59	.50	.62	.62	.67	.59
S_{16}	1.00	1.00	.50	.42	.88	.88	.67	.59	.62	.62	.67	.75
S_{17}	1.00	1.00	.50	.50	.75	.88	.67	.34	.50	.75	.50	.34
S_{18}	1.00	1.00	.42	.34	.88	.88	.50	.75	.38	.25	.67	.59

Subject	Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{19}	1.00	.88	.42	.34	.75	.88	.59	.75	.75	.75	.59	.67
S_{20}	1.00	1.00	.42	.34	.75	.75	.42	.25	.62	.62	.50	.59
S_{21}	1.00	1.00	.42	.50	.75	.62	.50	.59	.62	.50	.75	.75
S_{22}	1.00	1.00	.59	.59	.75	.75	.34	.42	.50	.50	.67	.75
S_{23}	1.00	1.00	.50	.67	.75	.75	.42	.59	.25	.25	.59	.75
S_{24}	1.00	1.00	.67	.75	.75	.75	.67	.59	.88	.88	.67	.59
S_{25}	1.00	1.00	.67	.75	.75	.75	.67	.84	.75	.88	.75	.75
S_{26}	.88	1.00	.75	.67	.75	.75	.92	.84	1.00	.88	.67	.75
S_{27}	1.00	1.00	.67	.75	.88	.75	.67	.75	1.00	.88	.59	.50
S_{28}	1.00	1.00	.84	.75	.75	.62	.42	.67	1.00	.50	.59	.50
S_{29}	1.00	1.00	.75	.75	.75	.75	.50	.42	.75	.88	.75	.75
S_{30}	1.00	1.00	.75	.67	.62	.62	.59	.75	.75	.75	.59	.84
S_{31}	1.00	1.00	.59	.75	.62	.75	.67	.75	.88	.88	.75	.75
S_{32}	.72	.88	.59	.67	.88	.62	.67	.59	.88	.88	.67	.84
S_{33}	1.00	1.00	.67	.75	.75	.75	.42	.42	.62	.75	.75	.75
S_{34}	1.00	1.00	.84	.75	.62	.62	.67	.34	.88	1.00	.50	.59
S_{35}	1.00	1.00	.84	.84	.88	.75	.59	.42	.88	.75	.67	.75
S_{36}	1.00	1.00	.75	.75	.88	.75	.34	.34	.88	.88	.84	.75

Subject	Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{37}	1.00	1.00	.67	.75	.88	.88	.59	.67	.67	.88	.84	.75
S_{38}	1.00	1.00	.75	.75	.88	.75	.67	.67	.75	.75	.67	.75
S_{39}	1.00	1.00	.84	.84	.88	.75	.67	.75	.88	.75	.50	.67
S_{40}	1.00	1.00	.67	.75	.88	.75	.50	.67	.88	.75	.92	.84
S_{41}	1.00	1.00	.84	.84	.88	.75	.42	.50	.88	.88	.75	.59
S_{42}	1.00	1.00	.84	.84	.88	.62	.25	.25	.75	.88	.67	.75
S_{43}	1.00	1.00	.84	.75	.88	.62	.67	.59	.75	.50	.34	.67
S_{44}	1.00	1.00	.75	.75	.75	.88	.42	.42	1.00	.88	.50	.42
S_{45}	1.00	1.00	.84	.84	.50	.75	.59	.50	.88	.88	.50	.67
S_{46}	1.00	1.00	.75	.75	.62	.62	.59	.50	.75	.88	.67	.84
S_{47}	1.00	1.00	.59	.50	.25	.38	.67	.75	.75	.75	.92	.92
S_{48}	1.00	1.00	.75	.75	.38	.25	.42	.34	.75	.62	.92	.75
S_{49}	.88	1.00	.84	.84	.50	.25	.42	.33	.62	.88	.67	.92
S_{50}	.75	.88	.84	.75	.00	1.00	.67	.50	.88	.88	.75	.84
S_{51}	1.00	1.00	.84	.84	.25	.25	.25	.59	.88	.75	.84	.84
S_{52}	1.00	1.00	.67	.50	.12	.12	.50	.42	.62	.75	.75	.67
S_{53}	1.00	1.00	.84	.84	.38	.25	.75	.67	.62	.75	.59	.67
S_{54}	1.00	1.00	.92	.42	.50	.50	.34	.59	.88	.62	.59	.75

Subject	Sex		Age		Ethnic Group		Education		Phys. Size		Dail. Region	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{55}	1.00	1.00	.59	.67	.50	.25	.42	.50	.75	.75	.75	.59
S_{56}	.88	1.00	.75	.84	.25	.38	.50	.42	.88	.75	1.00	.92
S_{57}	1.00	1.00	.67	.75	.38	.38	.59	.59	.88	.75	.50	.59
S_{58}	1.00	1.00	.42	.42	.38	.50	.42	.50	.62	.75	.67	.67
S_{59}	1.00	1.00	.59	.75	.25	.25	.67	.42	.88	.75	1.00	.92
S_{60}	.88	.88	.75	.84	.38	.38	.42	.50	.88	.88	.75	.75
S_{61}	1.00	1.00	.67	.67	.50	.50	.50	.59	.75	.75	.42	.59
S_{62}	1.00	1.00	.67	.75	.50	.50	.75	.59	.75	.75	.50	.75
S_{63}	1.00	1.00	.59	.75	.25	.25	.42	.59	.75	.75	.59	.59
S_{64}	.88	1.00	.59	.59	.50	.38	.25	.42	.62	.75	.67	.59
S_{65}	1.00	1.00	.75	.75	.38	.25	.34	.50	.75	.88	.59	.84
S_{66}	1.00	1.00	.67	.84	.38	.50	.42	.88	.62	.67	.67	.59
S_{67}	1.00	1.00	.67	.75	.38	.38	.42	.59	.62	.75	.67	.84
S_{68}	1.00	1.00	.75	.92	.50	.50	.75	.50	.75	.75	.84	.67
S_{69}	1.00	1.00	.84	.84	.38	.50	.42	.67	.75	.75	.67	.67
S_{70}	1.00	1.00	.75	.67	.75	.75	.59	.84	.88	.62	.50	.84
S_{71}	1.00	1.00	.59	.59	.75	.75	.67	.67	.88	.75	.75	.67
S_{72}	1.00	1.00	.67	.59	.50	.62	.59	.67	.75	.50	.59	.67

Subject	Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{73}	1.00	1.00	.59	.59	.88	.88	.34	.59	.62	.75	.67	.67
S_{74}	1.00	1.00	.50	.50	.88	.75	.75	.59	.62	.62	.67	.67
S_{75}	1.00	1.00	.50	.42	.88	.62	.67	.75	.62	.50	.67	.67
S_{76}	1.00	1.00	.59	.42	.75	.75	.67	.59	.62	.38	.84	.59
S_{77}	1.00	1.00	.50	.50	.62	.62	.75	.75	.62	.50	.59	.59
S_{78}	1.00	1.00	.59	.59	.50	.50	.67	.67	.75	.75	.50	.59
S_{79}	1.00	1.00	.59	.50	.75	.75	.59	.67	.62	.50	.67	.67
S_{80}	1.00	1.00	.67	.67	.38	.62	.42	.50	.62	.75	.67	.67
S_{81}	1.00	1.00	.75	.75	.88	.88	.75	.59	.62	.50	.67	.59
S_{82}	1.00	1.00	.59	.42	.88	.88	.67	.34	.88	.75	.59	.75
S_{83}	1.00	1.00	.67	.59	.75	.75	.67	.50	.75	.62	.59	.59
S_{84}	1.00	1.00	.34	.50	.88	.88	.59	.59	.62	.62	.59	.67
S_{85}	1.00	1.00	.50	.59	.88	.88	.42	.42	.88	.62	.50	.50
S_{86}	1.00	1.00	.42	.50	.50	.75	.62	.59	.50	.50	.67	.75
S_{87}	1.00	1.00	.59	.59	.88	1.00	.34	.17	.50	.25	.67	.67
S_{88}	1.00	1.00	.67	.50	.62	.62	.75	.75	.50	.88	.59	.59
S_{89}	1.00	1.00	.75	.50	.75	.75	.59	.59	.75	.75	.84	.75
S_{90}	1.00	1.00	.67	.67	.75	.62	.59	.67	.50	.50	.67	.75

Subject	Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{91}	1.00	1.00	.67	.75	.62	.62	.42	.50	.75	.50	.59	.75
S_{92}	1.00	1.00	.59	.34	.75	.75	.67	.59	.75	.62	.84	.67
S_{93}	1.00	1.00	.67	.67	.75	.75	.59	.34	.88	1.00	.50	.67
S_{94}	.88	1.00	.59	.67	1.00	.88	.50	.59	.62	1.00	.42	.25
S_{95}	1.00	1.00	.92	.84	.88	.88	.25	.50	1.00	1.00	.75	1.00
S_{96}	1.00	1.00	.67	.75	.62	.75	.42	.50	.75	.75	.59	.67
S_{97}	1.00	1.00	.67	.67	.75	.88	.84	.75	.50	.88	.59	.59
S_{98}	1.00	1.00	.75	.75	.75	.75	.59	.75	.75	.88	.59	.75
S_{99}	1.00	1.00	.84	.67	.75	.75	.84	.59	.88	.88	.84	.92
S_{100}	1.00	1.00	.59	.59	.67	.62	.50	.42	.88	.67	.67	.59
S_{101}	1.00	1.00	.67	.67	.62	.75	.67	.50	.75	.75	.59	.59
S_{102}	1.00	1.00	.92	.92	.75	.75	.67	.67	1.00	1.00	.92	.92
S_{103}	1.00	1.00	.67	.59	.75	.75	.75	.50	.75	.75	.67	.67
S_{104}	1.00	1.00	.75	.84	.75	.75	.67	.67	.88	.88	.84	.75
S_{105}	1.00	1.00	.67	.92	.75	.62	.59	.67	1.00	1.00	.75	.75
S_{106}	1.00	1.00	.84	.75	.75	.75	.67	.59	.88	.75	.67	.67
S_{107}	1.00	1.00	.50	.59	.75	.75	.59	.50	.75	.88	.84	.67
S_{108}	1.00	1.00	.67	.67	.38	.62	.59	.75	.88	.88	.67	.75

Subject	Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{109}	1.00	1.00	.75	.67	.75	.75	.67	.50	.75	.50	.75	.67
S_{110}	1.00	1.00	.67	.67	.75	.75	.67	.59	.88	.88	.92	.92
S_{111}	.88	1.00	.59	.59	.75	.75	.50	.50	.88	.75	.59	.59
S_{112}	1.00	1.00	.67	.84	.68	.28	.50	.50	.50	.75	.50	.59
S_{113}	1.00	1.00	.84	.84	.62	.75	.67	.59	.75	.75	.75	.84
S_{114}	1.00	1.00	.84	.84	.62	.88	.50	.42	1.00	.88	.84	.84
S_{115}	1.00	1.00	.84	.84	.88	.88	.59	.59	.75	.88	.42	.59
S_{116}	1.00	1.00	.67	.59	.62	.38	.42	.50	.88	.62	.67	.67
S_{117}	1.00	1.00	.92	.75	.38	.50	.50	.84	.75	.75	.75	.84
S_{118}	1.00	1.00	.67	.59	.50	.62	.42	.42	.75	.62	.67	.59
S_{119}	1.00	1.00	.84	.84	.38	.50	.67	.50	.88	.75	.67	.67
S_{120}	1.00	1.00	.67	.75	.50	.50	.33	.50	.62	.75	.67	.50
S_{121}	1.00	1.00	.75	.59	.62	.50	.59	.67	.88	.75	.92	.67
S_{122}	1.00	1.00	.59	.75	.50	.25	.33	.25	.88	.88	.59	.67
S_{123}	1.00	1.00	.67	.59	.12	.25	.50	.59	.88	.88	.67	.92
S_{124}	1.00	1.00	.92	.84	.38	.62	.67	.42	.88	1.00	.92	.67
S_{125}	1.00	1.00	.84	.92	.38	.25	.42	.42	.75	.75	.67	.67
S_{126}	1.00	1.00	.92	.92	.25	.62	.50	.42	.88	.75	.84	.59

Subject	Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{127}	1.00	1.00	.75	.84	.50	.38	.50	.50	.88	.75	.75	.75
S_{128}	1.00	1.00	.84	.50	.25	.25	.50	.25	.88	.88	.75	.84
S_{129}	1.00	1.00	.84	.67	.50	.25	.50	.67	.75	.75	.59	.50
S_{130}	.88	1.00	.67	.59	.50	.50	.50	.59	.75	.75	.59	.75
S_{131}	1.00	1.00	.42	.67	.50	.38	.50	.42	.88	.88	.84	.75
S_{132}	1.00	1.00	.84	.92	.62	.38	.50	.50	.88	.62	.67	.67
S_{133}	1.00	1.00	.75	.84	.25	.38	.59	.67	.75	.75	.59	.50
S_{134}	1.00	1.00	.67	.59	.50	.38	.50	.34	.88	.75	.50	.67
S_{135}	1.00	1.00	.75	.84	.50	.38	.75	.42	.88	.88	.67	.67
S_{136}	1.00	1.00	.92	.92	.38	.38	.75	.50	.62	.88	.75	.67
S_{137}	1.00	.75	.75	.67	.38	.38	.59	.42	.75	.62	.67	.59
S_{138}	1.00	.75	.75	.84	.38	.38	.59	.50	.88	.88	.84	.75

APPENDIX G

PROPORTION CORRECT ON EACH SPEAKER CHARACTERISTIC FOR THE TRAINED AND UNTRAINED GROUPS UNDER THE SPEECH TREATMENT COMBINATIONS FOR THE TEST AND RETEST CONDITIONS

UNTRAINED SUBJECTS

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_1	SpNo	1.00	1.00	.33	.33	.50	.50	.33	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	.67	1.00	1.00	.33	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.67	1.00	.50	.33	.33
	PrTe	1.00	1.00	1.00	.67	1.00	1.00	.33	.67	1.00	1.00	.67	.67
S_2	SpNo	1.00	1.00	.67	.67	.50	.00	.33	.67	1.00	1.00	.33	.67
	SpTe	1.00	1.00	.67	.67	1.00	1.00	1.00	1.00	.00	.50	.67	.67
	PrNo	1.00	1.00	.33	1.00	1.00	1.00	.33	.67	.50	1.00	.33	.33
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	.50	.67	1.00
S_3	SpNo	1.00	1.00	.00	.33	.00	.50	.33	.33	1.00	1.00	.33	.33
	SpTe	1.00	.50	.00	.33	1.00	1.00	.67	.33	.00	.50	.67	1.00
	PrNo	1.00	1.00	.33	.33	1.00	1.00	.33	.33	.50	.50	.00	.67
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.33	.33	.50	.50	.67	1.00
S_4	SpNo	1.00	1.00	.67	.67	.00	.50	.67	.33	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	.67	.67	1.00	1.00	1.00	1.00	.00	.50	1.00	1.00
	PrNo	1.00	1.00	.33	.33	1.00	1.00	1.00	.00	1.00	.50	.67	.67
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	.00	.33	.50	.50	1.00	.67
S_5	SpNo	1.00	1.00	.33	.33	.00	.50	.33	.33	1.00	1.00	.33	.33
	SpTe	1.00	1.00	.33	.33	1.00	1.00	1.00	.67	.00	.00	.67	.67
	PrNo	1.00	1.00	.33	.33	1.00	1.00	.67	1.00	.50	.50	.67	.67
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	.50	1.00	1.00
S_6	SpNo	1.00	1.00	.67	.33	.50	.00	.33	.67	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.67	.33	1.00	1.00	1.00	1.00	.50	.50	.33	.33
	PrNo	1.00	1.00	.33	.67	1.00	1.00	1.00	.67	.50	.50	.33	.67
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.67	.33	1.00	.50	1.00	1.00
S_7	SpNo	1.00	1.00	.33	.67	.00	.00	.67	.67	1.00	.50	.67	.67
	SpTe	1.00	1.00	.67	1.00	1.00	1.00	1.00	1.00	.50	1.00	.67	.67
	PrNo	1.00	1.00	.33	.33	1.00	1.00	1.00	1.00	.00	.50	.33	.67
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	1.00	1.00	1.00

UNTRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_8	SpNo	1.00	1.00	.33	.33	.50	.50	1.00	.33	1.00	1.00	.33	.67
	SpTe	1.00	1.00	.33	.33	1.00	1.00	.67	.67	1.00	.50	.67	.67
	PrNo	1.00	1.00	1.00	.67	1.00	1.00	.67	.33	.50	.50	1.00	.33
	PrTe	1.00	1.00	1.00	.67	1.00	1.00	.67	.33	.50	.50	1.00	.33
S_9	SpNo	1.00	1.00	.00	.00	.00	.50	.00	1.00	1.00	1.00	.33	.33
	SpTe	1.00	1.00	.00	.67	.50	1.00	.67	.33	1.00	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.33	1.00	.50	.00	.00	.33
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.33	.00	.50	.50	.33	.00
S_{10}	SpNo	1.00	1.00	.67	.67	.50	.50	.67	1.00	1.00	1.00	.33	.67
	SpTe	1.00	1.00	.67	.00	1.00	1.00	.67	.67	.00	.50	.67	.33
	PrNo	1.00	1.00	.33	.33	1.00	1.00	1.00	.67	.50	.50	.67	.67
	PrTe	1.00	1.00	.67	1.00	.50	.50	.00	.33	.50	.50	1.00	.33
S_{11}	SpNo	1.00	1.00	.67	.33	.50	.50	.00	.33	1.00	1.00	.67	.33
	SpTe	1.00	1.00	.33	.67	1.00	1.00	.33	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	.33	.33	.50	1.00	.67	.67	.50	.50	.33	.03
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.33	.33	.50	.50	.67	.33
S_{12}	SpNo	1.00	1.00	.00	.33	.00	.00	.33	.67	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.67	.33	1.00	1.00	.00	.67	.50	.50	1.00	.33
	PrNo	1.00	1.00	1.00	.33	1.00	1.00	.00	.33	1.00	1.00	.00	.67
	PrTe	1.00	1.00	.33	.67	1.00	1.00	.00	.00	.50	.50	1.00	.67
S_{13}	SpNo	1.00	1.00	.33	.33	.50	.50	.67	.67	.50	1.00	1.00	1.00
	SpTe	1.00	.50	.67	.33	1.00	1.00	.67	.67	.50	.50	.67	.33
	PrNo	1.00	1.00	.67	1.00	1.00	1.00	.67	.67	1.00	.50	.67	.33
	PrTe	1.00	1.00	.67	1.00	1.00	1.00	.67	.33	.50	.00	1.00	1.00
S_{14}	SpNo	1.00	1.00	.33	.00	.00	.00	.67	.67	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	1.00	.50	1.00	.67	.33	.50	.50	.67	.33
	PrNo	1.00	1.00	.67	1.00	1.00	.50	.00	.00	.00	.50	.33	.33
	PrTe	1.00	1.00	1.00	.67	1.00	1.00	.33	.67	.50	.00	1.00	1.00

UNTRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{15}	SpNo	1.00	1.00	.33	.33	.00	.50	.67	1.00	1.00	1.00	.67	.33
	SpTe	1.00	1.00	.67	.67	1.00	1.00	1.00	1.00	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.00	.00	.50	.67	.33
	PrTe	1.00	1.00	.67	1.00	.50	1.00	.00	.00	1.00	.50	.67	1.00
S_{16}	SpNo	1.00	1.00	.33	.33	.50	.50	.67	.67	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.33	.33	1.00	1.00	.33	.67	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.33	1.00	1.00	1.00	.67	1.00	.50	.67	.67
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.67	.33	.00	.50	.67	1.00
S_{17}	SpNo	1.00	1.00	.67	.33	.00	.50	.67	.33	1.00	1.00	.00	.00
	SpTe	1.00	1.00	.00	.33	1.00	1.00	1.00	.33	.00	.50	1.00	.67
	PrNo	1.00	1.00	.67	1.00	1.00	1.00	1.00	.67	.50	1.00	.33	.00
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.00	.00	.50	.50	.67	.67
S_{18}	SpNo	1.00	1.00	.00	.00	.50	.50	.00	.67	1.00	.50	.67	.67
	SpTe	1.00	1.00	.33	.33	1.00	1.00	1.00	1.00	.00	.00	1.00	.67
	PrNo	1.00	1.00	.67	.33	1.00	1.00	.67	1.00	.50	.00	.33	.33
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.33	.33	.00	.50	.67	.67
S_{19}	SpNo	1.00	1.00	.33	.00	.00	.50	.00	.67	1.00	1.00	.67	.67
	SpTe	1.00	.50	.33	.67	1.00	1.00	.67	.67	1.00	.50	.67	1.00
	PrNo	1.00	1.00	.33	.67	1.00	.50	1.00	.67	1.00	.00	.33	.33
	PrTe	1.00	1.00	.67	1.00	1.00	1.00	.67	1.00	.00	.50	.67	.67
S_{20}	SpNo	1.00	1.00	.00	.33	.50	.50	.33	.00	1.00	1.00	.33	.67
	SpTe	1.00	1.00	.33	.33	1.00	1.00	.33	.33	.50	.50	.33	.33
	PrNo	1.00	1.00	.33	.00	.50	.50	.33	.33	.50	.50	.33	.33
	PrTe	1.00	1.00	1.00	.67	1.00	1.00	.67	.33	.50	.50	1.00	1.00
S_{21}	SpNo	1.00	1.00	.00	.00	.00	.00	.33	.33	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.33	.33	1.00	1.00	.33	.67	.50	.50	.67	.67
	PrNo	1.00	1.00	.33	.67	1.00	.50	.67	.67	.50	.50	.33	.67
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.67	.50	.00	1.00	1.00

UNTRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial.	Region
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{22}	SpNo	1.00	1.00	.67	.67	.00	.50	.33	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.33	.67	1.00	1.00	.67	.67	.50	.00	.33	.67
	PrNo	1.00	1.00	.33	.33	1.00	.50	.33	.67	.50	.50	1.00	1.00
	PrTe	1.00	1.00	1.00	.67	1.00	1.00	.00	.00	.00	.50	.67	1.00
S_{23}	SpNo	1.00	1.00	.67	.67	.50	1.00	.33	.67	.00	.50	1.00	1.00
	SpTe	1.00	1.00	.33	.67	.50	.50	.33	.67	.50	.00	.33	.67
	PrNo	1.00	1.00	.33	.33	1.00	.50	.67	.33	.00	.00	.33	.67
	PrTe	1.00	1.00	.67	1.00	1.00	1.00	.33	.67	.50	.50	.67	.67
S_{24}	SpNo	1.00	1.00	.67	1.00	1.00	1.00	1.00	.67	1.00	.50	.67	.67
	SpTe	1.00	1.00	1.00	.67	1.00	1.00	.33	1.00	.50	1.00	.67	.67
	PrNo	1.00	1.00	.33	.67	.50	.50	.67	.33	1.00	1.00	.67	.33
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.33	1.00	1.00	.67	.67
S_{25}	SpNo	1.00	1.00	.67	1.00	1.00	1.00	.67	1.00	1.00	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.67	.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.33	.33	.50	.50	1.00	1.00	1.00	1.00	.67	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	.67	.67
S_{26}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.67	1.00	.50	.33	.33
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	1.00	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.67	.33	.50	.50	1.00	.67	1.00	1.00	.67	.67
	PrTe	.50	1.00	.33	.33	.50	.50	1.00	1.00	1.00	1.00	.67	1.00
S_{27}	SpNo	1.00	1.00	1.00	1.00	1.00	.50	.67	.67	1.00	.50	.33	.33
	SpTe	1.00	1.00	.67	1.00	1.00	1.00	.67	1.00	1.00	1.00	.67	.33
	PrNo	1.00	1.00	.67	.67	1.00	.50	.67	.67	1.00	1.00	.33	.33
	PrTe	1.00	1.00	.33	.33	.50	.50	.67	.67	1.00	1.00	1.00	1.00
S_{28}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.00	.67	1.00	.50	.33	.33
	SpTe	1.00	1.00	1.00	1.00	.50	1.00	.67	1.00	1.00	.50	.67	.67
	PrNo	1.00	1.00	.67	.33	.50	.00	.33	.33	1.00	.50	.67	.67
	PrTe	1.00	1.00	.67	.67	1.00	.50	.67	.67	1.00	.50	.67	.67

UNTRAINED SUBJECTS--Continued

Subject		Sex Test	Sex Retest	Age Test	Age Retest	Ethnic Group Test	Ethnic Group Retest	Education Test	Education Retest	Phys. Size Test	Phys. Size Retest	Dial. Region Test	Dial. Region Retest
S_{29}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	.50	.33	.33
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.33	.50	1.00	1.00	1.00
	PrNo	1.00	1.00	.33	.67	.50	.50	.33	.33	1.00	1.00	.67	.67
	PrTe	1.00	1.00	.67	.33	.50	.50	.67	.67	1.00	1.00	1.00	1.00
S_{30}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.33	.67	.00	.00	.33	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	1.00	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.33	.33	.50	.00	1.00	.33	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.67	.33	.00	.50	.67	1.00	1.00	1.00	.67	1.00
S_{31}	SpNo	1.00	1.00	.67	1.00	.50	1.00	.67	1.00	1.00	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.67	.50	1.00	1.00	1.00
	PrNo	1.00	1.00	.33	.33	.50	.50	1.00	.67	1.00	1.00	.67	.67
	PrTe	1.00	1.00	.33	.67	.50	.50	.67	.67	1.00	1.00	.67	.67
S_{32}	SpNo	1.00	1.00	.33	.67	1.00	1.00	.67	.67	1.00	.50	.33	.67
	SpTe	1.00	1.00	1.00	.67	1.00	.50	1.00	.67	1.00	.50	.67	1.00
	PrNo	.50	.50	.33	.67	1.00	.50	.33	.67	.50	1.00	1.00	1.00
	PrTe	.50	1.00	.67	.67	.50	.50	.67	.33	1.00	1.00	.67	.67
S_{33}	SpNo	1.00	1.00	.67	1.00	1.00	1.00	.00	.33	.00	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	1.00	1.00	1.00	.67
	PrNo	1.00	1.00	.33	.33	.50	.50	.67	.33	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	.50	.50	.67	.67
S_{34}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.67	.33	1.00	1.00	.33	.67
	SpTe	1.00	1.00	1.00	1.00	.50	1.00	.33	.00	1.00	1.00	.67	.67
	PrNo	1.00	1.00	.67	.33	1.00	.50	.67	.33	.50	1.00	.33	.33
	PrTe	1.00	1.00	.67	.67	.50	.50	1.00	.67	1.00	1.00	.67	.67
S_{35}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.67	.33	.50	.50	.33	.33
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.67	1.00	.50	1.00	1.00
	PrNo	1.00	1.00	.67	.67	1.00	.50	.67	.00	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	1.00	1.00

UNTRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{36}	SpNo	1.00	1.00	1.00	.67	1.00	1.00	.00	.33	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.00	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.33	.67	1.00	.50	.67	.67	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	.67	.67	.50	.50	.33	.33	1.00	1.00	1.00	.33
S_{37}	SpNo	1.00	1.00	1.00	.67	1.00	1.00	.33	.67	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	.50	1.00	.67	.67	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.33	.67	1.00	.50	.33	1.00	1.00	1.00	1.00	.33
	PrTe	1.00	1.00	.33	.67	1.00	1.00	1.00	.33	1.00	1.00	.67	.67
S_{38}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.00	.50	.33	.33
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.67	1.00	1.00	.67	1.00
	PrNo	1.00	1.00	.33	.33	1.00	.50	.67	.67	1.00	1.00	1.00	1.00
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.33	1.00	.50	.67	.67
S_{39}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	.00	.67	1.00
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.67	1.00	1.00	1.00	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	1.00	1.00	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	1.00	1.00	1.00	.00	.33
S_{40}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	.50	.67	.67
	SpTe	1.00	1.00	.67	1.00	1.00	1.00	.00	.33	1.00	.50	1.00	1.00
	PrNo	1.00	1.00	.33	.67	1.00	.50	.67	1.00	1.00	1.00	1.00	1.00
	PrTe	1.00	1.00	.67	.33	.50	.50	1.00	1.00	1.00	1.00	1.00	.67
S_{41}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	.50	1.00	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	1.00	1.00	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.33	.67	1.00	1.00	.67	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	.67	.33
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	.67	.33
S_{42}	SpNo	1.00	1.00	1.00	1.00	1.00	.50	.00	.33	.00	.50	.33	.33
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.67	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.67	.67	1.00	.50	.33	.00	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.33	.33	1.00	1.00	1.00	1.00

UNTRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{43}	SpNo	1.00	1.00	1.00	1.00	1.00	.50	.33	.00	.50	.00	.33	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.67	1.00	1.00	.00	.67
	PrNo	1.00	1.00	.67	.33	1.00	.50	.67	.67	1.00	.50	.67	1.00
	PrTe	1.00	1.00	.67	.67	.50	.50	1.00	1.00	.50	.50	.33	.33
S_{44}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.33	.00	1.00	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	1.00	1.00	.67	.33
	PrNo	1.00	1.00	.33	.33	.50	1.00	.67	.33	1.00	1.00	.33	.00
	PrTe	1.00	1.00	.67	.67	.50	.50	.33	1.00	1.00	1.00	.33	.67
S_{45}	SpNo	1.00	1.00	1.00	1.00	.50	1.00	.33	.33	.50	.50	.33	.67
	SpTe	1.00	1.00	1.00	1.00	.50	1.00	.67	.33	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	.00	.33
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	.67	.67
S_{46}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.33	.33	.50	.50	1.00	1.00
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.33	.50	1.00	.67	.67
	PrNo	1.00	1.00	.33	.33	.50	.50	.67	1.00	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.33	1.00	1.00	.67	1.00
S_{47}	SpNo	1.00	1.00	1.00	1.00	.00	.00	.67	.67	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	.67	.33	.00	.00	1.00	1.00	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	1.00	.33	.67	.50	1.00	1.00	1.00
	PrTe	1.00	1.00	.00	.00	.50	.50	.67	.33	1.00	1.00	1.00	1.00
S_{48}	SpNo	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	1.00	.67	.00	.00	.00	.00	.50	.50	.67	.33
	PrNo	1.00	1.00	.67	.67	.50	1.00	.67	.67	.50	1.00	1.00	1.00
	PrTe	1.00	1.00	.67	1.00	.50	.50	.67	.00	1.00	.00	1.00	1.00
S_{49}	SpNo	1.00	1.00	1.00	.67	.50	.00	.33	.33	.00	1.00	1.00	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.33	.33	1.00	.50	.33	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.67	.33	.50	1.00	.67	1.00
	PrTe	.50	1.00	.67	1.00	.50	.50	.33	.33	1.00	1.00	.67	1.00

UNTRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{50}	SpNo	1.00	1.00	1.00	.67	.00	1.00	.67	.33	1.00	1.00	.67	1.00
	SpTe	.50	.50	1.00	1.00	.00	1.00	.67	.67	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	.00	1.00	.67	.67	1.00	1.00	.67	1.00
	PrTe	.50	1.00	.67	.67	.00	1.00	.67	.33	1.00	1.00	1.00	.67
S_{51}	SpNo	1.00	1.00	1.00	1.00	.00	.00	.33	.33	1.00	.50	.67	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.33	.67	.50	.50	1.00	1.00
	PrNo	1.00	1.00	.67	.67	.50	.50	.33	.67	1.00	1.00	1.00	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.00	.67	1.00	1.00	.67	.67
S_{52}	SpNo	1.00	1.00	1.00	.67	.00	.00	.67	.67	.00	.50	1.00	1.00
	SpTe	1.00	1.00	.67	.33	.00	.00	.33	.33	.50	.50	.33	1.00
	PrNo	1.00	1.00	.67	.33	.00	.50	.67	.67	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	.33	.33	.50	.00	.33	.00	1.00	1.00	1.00	.67
S_{53}	SpNo	1.00	1.00	1.00	1.00	.00	.00	.33	.33	.50	.50	.33	.33
	SpTe	1.00	1.00	1.00	1.00	.00	.00	1.00	1.00	.50	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	1.00	.67	.50	1.00	.33	1.00
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	.67	.67
S_{54}	SpNo	1.00	1.00	1.00	.33	1.00	.50	.33	.67	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	1.00	.33	.50	.50	.67	.67	.50	.50	.33	.33
	PrNo	1.00	1.00	1.00	.67	.00	.50	.33	.67	1.00	.50	.33	.67
	PrTe	1.00	1.00	.67	.33	.50	.50	.00	.33	1.00	1.00	.67	1.00
S_{55}	SpNo	1.00	1.00	.67	.67	.50	.00	.00	.33	.50	.50	1.00	.67
	SpTe	1.00	1.00	.67	1.00	.00	.00	.67	1.00	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.67	.33	1.00	1.00	.33	.33
	PrTe	1.00	1.00	.33	.33	.50	.50	.33	.00	1.00	1.00	1.00	.67
S_{56}	SpNo	1.00	1.00	1.00	1.00	.00	.50	.67	.33	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	.67	.67	.00	.00	.33	.33	.50	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	1.00	1.00
	PrTe	1.00	1.00	.67	1.00	.50	.50	.33	.00	1.00	1.00	1.00	1.00

UNTRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{57}	SpNo	1.00	1.00	.67	1.00	.50	.50	.33	.33	1.00	.50	.33	.33
	SpTe	1.00	1.00	.67	.67	.00	.00	.67	.67	.50	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	.50	1.00	.67	.67	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.33	.67	.50	.00	.67	.67	1.00	1.00	.33	.67
S_{58}	SpNo	1.00	1.00	.33	.67	.00	.50	.33	.67	.50	.50	1.00	.67
	SpTe	1.00	1.00	.33	.33	.00	.50	.67	.67	.50	1.00	1.00	.33
	PrNo	1.00	1.00	.67	.33	1.00	.50	.67	.67	.50	1.00	.00	1.00
	PrTe	1.00	1.00	.33	.33	.50	.50	.00	.00	1.00	.50	.67	.67
S_{59}	SpNo	1.00	1.00	1.00	1.00	.00	.00	.33	.33	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	.33	.67	.00	.00	1.00	.67	.50	.50	1.00	1.00
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.33	1.00	1.00	1.00	.67
	PrTe	1.00	1.00	.33	.67	.50	.50	.67	.33	1.00	1.00	1.00	1.00
S_{60}	SpNo	.50	.50	1.00	1.00	.00	.00	.33	.33	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.67	1.00	.00	.00	1.00	1.00	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.33	.67	1.00	1.00	.67	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.00	.00	1.00	1.00	.67	1.00
S_{61}	SpNo	1.00	1.00	1.00	1.00	.00	.50	.33	.33	.50	1.00	.33	.67
	SpTe	1.00	1.00	.67	.67	.50	.50	.33	.67	.50	.50	.33	.33
	PrNo	1.00	1.00	.67	.67	1.00	.50	.67	.67	1.00	.50	.33	.67
	PrTe	1.00	1.00	.33	.33	.50	.50	.67	.67	1.00	1.00	.67	.67
S_{62}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.33	.67	.50	.50	.00	.33
	SpTe	1.00	1.00	1.00	1.00	.00	.00	1.00	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.67	.67	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	.00	.33	.50	.50	1.00	.67	1.00	1.00	.67	1.00
S_{63}	SpNo	1.00	1.00	.67	.67	.00	.00	.33	.67	1.00	.50	.67	.33
	SpTe	1.00	1.00	.67	.67	.00	.00	.67	1.00	.00	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	.00	.67
	PrTe	1.00	1.00	.33	1.00	.50	.50	.00	.00	1.00	1.00	.67	.67

UNTRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{64}	SpNo	.50	1.00	1.00	1.00	.00	.00	.33	.33	.50	1.00	1.00	.67
	SpTe	1.00	1.00	.33	.33	.50	.50	.33	.67	.50	.50	.67	.33
	PrNo	1.00	1.00	.67	.33	1.00	.50	.33	.33	.50	.50	.67	.67
	PrTe	1.00	1.00	.33	.67	.50	.50	.00	.33	1.00	1.00	.33	.67
S_{65}	SpNo	1.00	1.00	1.00	1.00	.00	.00	.33	.33	1.00	1.00	.67	1.00
	SpTe	1.00	1.00	1.00	.67	.00	.00	.33	.67	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.67	.67	.50	1.00	.33	1.00
	PrTe	1.00	1.00	.67	1.00	.50	.50	.00	.33	1.00	1.00	.67	.67
S_{66}	SpNo	1.00	1.00	1.00	1.00	.00	.50	.33	.33	1.00	.50	.67	1.00
	SpTe	1.00	1.00	1.00	1.00	1.00	.00	.33	.67	.50	.50	.67	.67
	PrNo	1.00	1.00	.33	.67	1.00	.50	.67	.33	1.00	.50	.67	.33
	PrTe	1.00	1.00	.33	.67	.50	.50	.67	.33	1.00	1.00	.67	.33
S_{67}	SpNo	1.00	1.00	1.00	.67	.50	.50	.33	.33	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	.67	1.00	.00	.00	.33	.67	.00	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.33	.67	.50	1.00	1.00	1.00
	PrTe	1.00	1.00	.33	1.00	.50	.50	.67	.67	1.00	1.00	.33	.67
S_{68}	SpNo	1.00	1.00	1.00	1.00	.50	.50	1.00	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	1.00	1.00	.50	.00	.67	.67	.50	.50	1.00	1.00
	PrNo	1.00	1.00	.33	.67	.50	1.00	.67	.67	.50	.50	.67	.33
	PrTe	1.00	1.00	.67	1.00	.50	.50	.67	.33	1.00	1.00	1.00	.67
S_{69}	SpNo	1.00	1.00	1.00	1.00	.50	.00	.00	.33	.50	.50	1.00	.33
	SpTe	1.00	1.00	1.00	1.00	.00	.50	1.00	1.00	.50	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	.50	1.00	.67	.67	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	.00	.67	1.00	1.00	.33	1.00

TRAINED SUBJECTS

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Retion	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_1	SpNo	1.00	1.00	.67	.33	.50	.50	.33	.67	1.00	1.00	.33	1.00
	SpTe	1.00	1.00	.67	.67	1.00	1.00	.67	1.00	1.00	.50	.67	1.00
	PrNo	1.00	1.00	1.00	.67	.50	.50	.67	1.00	1.00	.50	.33	.33
	PrTe	1.00	1.00	.67	1.00	1.00	1.00	.67	.67	.50	.50	.67	1.00
S_2	SpNo	1.00	1.00	.67	.33	.50	.50	.33	.67	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.67	.33	1.00	1.00	1.00	.67	.50	.50	.67	.33
	PrNo	1.00	1.00	.33	.67	.50	.50	.67	1.00	1.00	1.00	1.00	1.00
	PrTe	1.00	1.00	.67	1.00	1.00	1.00	.67	.33	1.00	.50	1.00	1.00
S_3	SpNo	1.00	1.00	.33	.67	.00	.00	.00	.33	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	.67	.33	1.00	1.00	1.00	1.00	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.33	.50	.50	.67	1.00	.50	.50	.33	.33
	PrTe	1.00	1.00	1.00	1.00	.50	1.00	.67	.33	1.00	.50	1.00	.67
S_4	SpNo	1.00	1.00	.33	.67	.50	.50	.00	.00	1.00	1.00	.33	.67
	SpTe	1.00	1.00	.67	.33	1.00	1.00	1.00	1.00	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.33	.67	.50	1.00	.33	.67
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.00	.67	.50	.50	1.00	.67
S_5	SpNo	1.00	1.00	.33	.00	.50	.50	.67	.33	1.00	1.00	.67	.33
	SpTe	1.00	1.00	.33	.67	1.00	1.00	1.00	.67	.50	.00	1.00	.67
	PrNo	1.00	1.00	.67	.33	1.00	1.00	1.00	1.00	.50	1.00	.33	.07
	PrTe	1.00	1.00	.67	1.00	1.00	1.00	.33	.33	.50	.50	.67	1.00
S_6	SpNo	1.00	1.00	.33	.33	.50	.00	.67	.67	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	.00	.00	1.00	1.00	.67	.67	.50	.00	.67	.67
	PrNo	1.00	1.00	.67	.33	1.00	.50	.67	1.00	.50	.50	.00	.00
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.67	.50	.50	1.00	1.00
S_7	SpNo	1.00	1.00	.33	.00	.50	.50	.33	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	.33	1.00	1.00	.67	1.00	.50	.00	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	1.00	1.00	.50	.50	.33	.67
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.67	.00	.50	.00	1.00	.67

TRAINED SUBJECTS--Continued

Subject		Sex Test	Sex Retest	Age Test	Age Retest	Ethnic Group Test	Ethnic Group Retest	Education Test	Education Retest	Phys. Size. Test	Phys. Size. Retest	Dial. Region Test	Dial. Region Retest
S_8	SpNo	1.00	1.00	.67	.33	.00	.00	.67	.33	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.00	.33	1.00	1.00	.67	1.00	.50	.00	.67	.67
	PrNo	1.00	1.00	.33	.33	.50	.50	.67	1.00	.50	.50	.67	.33
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.67	.50	.50	1.00	.67
S_9	SpNo	1.00	1.00	.33	.67	.00	.00	.67	.67	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	.33	1.00	1.00	1.00	.67	1.00	.50	.67	.67
	PrNo	1.00	1.00	.33	.33	.50	.50	.67	1.00	.50	1.00	.00	.00
	PrTe	1.00	1.00	1.00	1.00	.50	.50	.33	.33	.50	.50	1.00	1.00
S_{10}	SpNo	1.00	1.00	.00	.00	.50	.50	.33	.33	.50	.50	.33	.67
	SpTe	1.00	1.00	.67	1.00	1.00	1.00	.67	.67	.50	.00	.67	.67
	PrNo	1.00	1.00	1.00	.33	1.00	1.00	.33	1.00	1.00	1.00	.33	.33
	PrTe	1.00	1.00	.67	.67	.50	.50	1.00	.67	.50	.50	.67	.67
S_{11}	SpNo	1.00	1.00	.33	.67	.00	.00	.33	.33	1.00	1.00	.67	.33
	SpTe	1.00	1.00	.67	.67	.00	1.00	1.00	.67	.00	.50	.33	.67
	PrNo	1.00	1.00	.67	.33	1.00	1.00	.00	.67	1.00	1.00	1.00	1.00
	PrTe	1.00	1.00	1.00	1.00	.50	.50	.33	.33	.50	.50	.67	.67
S_{12}	SpNo	1.00	1.00	.67	.67	1.00	.50	1.00	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	.67	1.00	1.00	1.00	.67	.50	.00	.33	.33
	PrNo	1.00	1.00	.67	.67	.50	1.00	.33	1.00	.50	.50	.67	.33
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.33	.50	.50	1.00	1.00
S_{13}	SpNo	1.00	1.00	.67	.33	.50	.50	.33	.33	1.00	1.00	.67	1.00
	SpTe	1.00	1.00	.67	.33	1.00	1.00	1.00	.00	1.00	.50	.33	.67
	PrNo	1.00	1.00	.33	.33	1.00	1.00	.67	.33	1.00	1.00	.33	.33
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.67	.67	.50	.50	1.00	1.00
S_{14}	SpNo	1.00	1.00	.33	.33	.00	.00	.33	.67	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.67	.33	1.00	1.00	.67	.67	.50	.50	.33	.67
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.67	.33	1.00	.50	.67	.33
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.33	.50	.50	1.00	.67

TRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{15}	SpNo	1.00	1.00	.00	.33	.50	.50	.33	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	.67	1.00	1.00	1.00	1.00	.00	.00	.67	.67
	PrNo	1.00	1.00	.33	.67	1.00	1.00	.33	.33	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.33	.33	1.00	1.00	.67	.67	.50	.50	.67	.67
S_{16}	SpNo	1.00	1.00	.33	.67	.50	.50	.33	.00	1.00	1.00	.67	.33
	SpTe	1.00	1.00	.67	1.00	1.00	1.00	.67	.67	1.00	.00	.33	.33
	PrNo	1.00	1.00	.00	.00	1.00	1.00	.33	.67	1.00	1.00	.67	.33
	PrTe	1.00	1.00	1.00	.67	1.00	1.00	.33	.33	.50	.50	.33	1.00
S_{17}	SpNo	1.00	1.00	.33	.67	.00	.00	.67	.33	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	.33	.33	1.00	1.00	1.00	1.00	.00	.00	.33	.33
	PrNo	1.00	1.00	.33	.33	1.00	.50	.33	.33	.50	1.00	.33	.67
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.33	.33	.50	.50	1.00	1.00
S_{18}	SpNo	1.00	1.00	.67	.67	1.00	1.00	.00	.33	.50	.50	1.00	.67
	SpTe	1.00	1.00	.33	.67	.50	1.00	.00	.00	.00	.00	.33	.33
	PrNo	1.00	1.00	.33	.33	1.00	1.00	.33	.33	1.00	.50	.33	.67
	PrTe	1.00	1.00	1.00	.67	1.00	1.00	1.00	.00	.50	.00	1.00	1.00
S_{19}	SpNo	1.00	1.00	.00	.00	.00	.00	.33	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	.67	1.00	1.00	1.00	1.00	.50	1.00	.67	.67
	PrNo	1.00	1.00	1.00	1.00	.50	.50	.67	1.00	.00	1.00	.33	.33
	PrTe	1.00	1.00	1.00	.33	1.00	1.00	1.00	.67	.50	.50	.67	.67
S_{20}	SpNo	1.00	1.00	.67	.00	.50	.50	.67	.33	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.33	.33	1.00	1.00	.33	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	1.00	1.00	1.00	1.00	.67	1.00	1.00	1.00	.67	.67
	PrTe	1.00	1.00	1.00	.67	.50	.50	.67	.67	.50	.50	1.00	1.00
S_{21}	SpNo	1.00	1.00	.33	.00	.50	.00	.33	.67	.50	1.00	.67	.67
	SpTe	1.00	1.00	.67	1.00	1.00	1.00	1.00	.67	.50	.00	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.67	.67	.50	.50	.33	.67
	PrTe	1.00	1.00	1.00	1.00	.50	1.00	.33	.67	.50	.50	1.00	1.00

TRAINED SUBJECTS--Continued

Subject		Sex Test	Sex Retest	Ate Test	Ate Retest	Ethnic Group Test	Ethnic Group Retest	Education Test	Education Retest	Phys. Size Test	Phys. Size Retest	Dial. Region Test	Dial. Region Retest
S_{22}	SpNo	1.00	1.00	.33	.67	.00	.00	.33	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	.67	1.00	1.00	.67	.67	1.00	.00	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.33	.67	.50	.50	.33	.67
	PrTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	.50	.67	1.00
S_{23}	SpNo	1.00	1.00	.00	.00	.50	.50	.33	.33	1.00	1.00	1.00	.67
	SpTe	1.00	1.00	.67	.33	1.00	1.00	1.00	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.33	.50	1.00	.67	1.00	1.00	.50	.67	.03
	PrTe	1.00	1.00	1.00	.67	1.00	1.00	.67	.67	.50	.50	1.00	1.00
S_{24}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.67	.00	.50	1.00	.33	.67
	SpTe	1.00	1.00	.67	.67	1.00	1.00	.33	.33	1.00	1.00	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.33	1.00	1.00	.67	.33
	PrTe	1.00	1.00	.33	.33	.50	.50	.67	.67	1.00	1.00	.33	1.00
S_{25}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.67	1.00	.50	1.00	.67	.33
	SpTe	1.00	1.00	.67	.67	1.00	1.00	.33	.33	1.00	1.00	.67	.33
	PrNo	.50	1.00	.33	.67	1.00	.50	.67	.67	.50	1.00	.00	.33
	PrTe	1.00	1.00	.33	.33	1.00	1.00	.33	.33	.50	1.00	.33	.00
S_{26}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	1.00	1.00	.67	1.00
	SpTe	1.00	..00	1.00	1.00	1.00	1.00	.00	.33	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.33	1.00	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	1.00	.67	.50	.50	.67	.67	1.00	1.00	.67	1.00
S_{27}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.33	.67	.50	.50	.67	1.00
	SpTe	1.00	1.00	.67	1.00	.50	1.00	.00	.00	1.00	1.00	.67	1.00
	PrNo	1.00	1.00	.33	.67	.50	.50	1.00	.67	.50	1.00	.67	.33
	PrTe	1.00	1.00	.67	33	.50	.50	.33	.67	1.00	.50	.33	.33
S_{28}	SpNo	1.00	1.00	.67	1.00	1.00	1.00	.67	.67	.00	.50	.67	.33
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.33	.50	1.00	.67	1.00
	PrNo	1.00	1.00	.33	.33	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33
	PrTe	1.00	1.00	.67	.33	.00	.50	1.00	1.00	.50	1.00	.67	.67

TRAINED SUBJECTS--Continued

Subject		Sex Test	Sex Retest	Age Test	Age Retest	Ethnic Group Test	Ethnic Group Retest	Education Test	Education Retest	Phys. Size Test	Phys. Size Retest	Dial. Region Test	Dial. Region Retest
S_{29}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.33	1.00	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.67	1.00	1.00	.33	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.67	1.00	1.00	1.00	.67	.67
	PrTe	1.00	1.00	.33	.33	.50	1.00	.67	.33	.50	1.00	.67	1.00
S_{30}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.67	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	.67	1.00	1.00	1.00	.67	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.67	.67	.50	.50	1.00	.67	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	.67	.33	.50	.50	.33	.33	1.00	1.00	1.00	1.00
S_{31}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.00	.00	1.00	.50	.67	.33
	SpTe	1.00	1.00	.67	.67	.50	1.00	.33	.00	.50	1.00	1.00	.67
	PrNo	1.00	1.00	.33	.67	1.00	1.00	1.00	1.00	.50	1.00	.33	.67
	PrTe	1.00	1.00	.33	.33	.50	.50	.67	.67	1.00	1.00	.67	.67
S_{32}	SpNo	1.00	1.00	1.00	1.00	.50	1.00	.67	.67	.00	.00	.67	.33
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.00	1.00	1.00	.67	.67
	PrNo	1.00	1.00	.33	.33	.50	.50	.67	.67	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.33	.33	.50	.50	1.00	.67	1.00	1.00	.67	.67
S_{33}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	1.00	1.00	.50	.50	1.00	1.00	1.00	1.00	1.00	1.00
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	1.00	1.00
S_{34}	SpNo	1.00	1.00	1.00	.67	1.00	1.00	.67	.33	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	.67	1.00	1.00	.67	.67	1.00	1.00	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	1.00	.67	.50	.50	.33	1.00
	PrTe	1.00	1.00	.00	.33	.50	.50	.67	.33	1.00	1.00	1.00	.33
S_{35}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.67	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.00	.33	1.00	1.00	1.00	.67
	PrNo	1.00	1.00	.67	1.00	.50	.50	1.00	1.00	1.00	1.00	1.00	.67
	PrTe	1.00	1.00	.33	.33	.50	.50	.67	.67	1.00	1.00	.67	1.00

TRAINED SUBJECTS--Continued

Subject		Sex Test	Sex Retest	Age Test	Age Retest	Ethnic Group Test	Ethnic Group Retest	Education Test	Education Retest	Phys. Size Test	Phys. Size Retest	Dial. Region Test	Dial. Region Retest
S_{36}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.33	.67	1.00	1.00	.67	.67
	SpTe	1.00	1.00	.67	1.00	1.00	1.00	.67	.67	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.67	1.00	1.00	.50	.67	.67	1.00	1.00	1.00	.67
	PrTe	1.00	1.00	.33	.67	.50	.50	.67	.67	1.00	1.00	.33	.67
S_{37}	SpNo	1.00	1.00	1.00	.67	1.00	1.00	.67	.33	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.33	1.00	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	1.00	1.00	1.00	.67	.33
	PrTe	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	1.00	.33	1.00
S_{38}	SpNo	1.00	1.00	.67	1.00	1.00	1.00	.33	.33	.50	1.00	.33	.33
	SpTe	1.00	1.00	.66	.67	1.00	1.00	.33	.33	1.00	.50	1.00	1.00
	PrNo	1.00	1.00	.33	.33	.50	.50	1.00	.67	1.00	1.00	1.00	.33
	PrTe	1.00	1.00	.33	.33	.50	.50	.67	.67	.50	1.00	1.00	1.00
S_{39}	SpNo	1.00	1.00	1.00	1.00	.50	.50	1.00	1.00	.50	.50	.67	1.00
	SpTe	1.00	1.00	.67	.67	.50	1.00	.00	.33	1.00	1.00	.33	1.00
	PrNo	1.00	1.00	.33	.67	.50	.50	1.00	1.00	1.00	1.00	1.00	.33
	PrTe	1.00	1.00	.67	.67	.00	.50	.33	.67	1.00	1.00	.67	.67
S_{40}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.67	1.00	.50	.00	.33	.33
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.00	1.00	.50	.67	1.00
	PrNo	1.00	1.00	.67	.33	.50	.50	.67	.67	1.00	1.00	1.00	.67
	PrTe	1.00	1.00	.33	.33	.50	.50	1.00	.33	.50	.50	1.00	.67
S_{41}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.67	.67	.50	.50	.67	.67
	SpTe	1.00	1.00	.67	.67	1.00	1.00	.33	.67	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.67	.67	.50	.50	1.00	.67	1.00	1.00	1.00	1.00
	PrTe	1.00	1.00	.33	.33	.50	.50	.67	.33	1.00	1.00	1.00	1.00
S_{42}	SpNo	1.00	1.00	1.00	1.00	.50	1.00	.33	.00	.50	.50	.33	.33
	SpTe	1.00	1.00	.67	.67	1.00	1.00	.33	.33	1.00	1.00	1.00	.67
	PrNo	.50	1.00	.33	.33	1.00	.50	.67	.67	1.00	1.00	.67	.67
	PrTe	1.00	1.00	.33	.33	.50	.50	.67	1.00	1.00	.50	.33	.67

TRAINED SUBJECTS--Continued

Subject		Sex Test	Sex Retest	Age Test	Age Retest	Ethnic Group Test	Ethnic Group Retest	Education Test	Education Retest	Phys. Size Test	Phys. Size Retest	Dial. Region Test	Dial. Region Retest
S_{43}	SpNo	1.00	1.00	1.00	1.00	.50	1.00	.33	.33	.00	.00	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	.50	1.00	.33	.33
	PrNo	1.00	1.00	.33	.67	.50	1.00	1.00	1.00	1.00	1.00	.33	.33
	PrTe	1.00	1.00	.33	.67	.50	.50	.67	.67	.50	1.00	.67	1.00
S_{44}	SpNo	1.00	1.00	.67	.67	1.00	1.00	.67	.67	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.67	.33	.50	.50	.67	1.00
	PrNo	1.00	1.00	1.00	1.00	.50	.50	.67	.67	1.00	1.00	1.00	.67
	PrTe	1.00	1.00	.67	.67	.00	.50	.67	.67	1.00	1.00	.67	1.00
S_{45}	SpNo	1.00	1.00	1.00	1.00	.50	1.00	.33	.00	1.00	1.00	.33	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.00	.00	1.00	1.00	1.00	1.00
	PrNo	1.00	1.00	.67	1.00	.50	1.00	.67	1.00	1.00	.50	1.00	1.00
	PrTe	1.00	1.00	.67	.33	.50	.50	1.00	.67	1.00	1.00	1.00	.67
S_{46}	SpNo	1.00	1.00	1.00	1.00	1.00	1.00	.67	1.00	1.00	1.00	.67	.67
	SpTe	1.00	1.00	1.00	1.00	1.00	1.00	.33	.33	.50	1.00	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	.50	.00	.33
	PrTe	1.00	1.00	.67	.67	1.00	1.00	.67	.33	.50	1.00	.33	.67
S_{47}	SpNo	1.00	1.00	.67	.33	.50	.50	.33	.67	1.00	.50	.67	.67
	SpTe	1.00	1.00	1.00	.67	.50	.00	.67	.33	.50	.50	.33	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.33	.33	1.00	.50	.67	.33
	PrTe	1.00	1.00	.33	.67	.50	.50	.33	.67	1.00	1.00	1.00	1.00
S_{48}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.67	.67	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	1,00	1.00	.00	.00	.67	1.00	.50	.50	1.00	1.00
	PrNo	1.00	1.00	.67	.33	.50	1.00	.67	1.00	.50	1.00	.33	.67
	PrTe	1.00	1.00	1.00	.67	.50	.50	.00	.67	1.00	1.00	.67	1.00
S_{49}	SpNo	1.00	1.00	.67	.00	.50	.50	1.00	.33	1.00	.50	.67	.67
	SpTe	1.00	1.00	.67	.67	.00	.50	.00	.00	.50	.50	.33	.67
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.33	.33	.50	1.00	1.00	.33
	PrTe	1.00	1.00	.67	1.00	.50	.50	.33	1.00	1.00	.50	.67	.67

TRAINED SUBJECTS--Continued

Subject		Sex Test	Sex Retest	Age Test	Age Retest	Ethnic Group Test	Ethnic Group Retest	Education Test	Education Retest	Phys. Size Test	Phys. Size Retest	Dial. Retion Test	Dial. Retion Retest
S_{50}	SpNo	1.00	1.00	1.00	.67	.50	.50	.67	.67	1.00	.50	.67	.33
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.33	.33	.50	.50	.33	.67
	PrNo	1.00	1.00	.67	.67	.50	1.00	1.00	.67	1.00	1.00	1.00	.67
	PrTe	1.00	1.00	.67	1.00	.50	.50	.67	.33	1.00	1.00	.67	1.00
S_{51}	SpNo	1.00	1.00	.33	1.00	.50	.50	.33	.67	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.33	.67	.50	.50	.67	.00
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.33	.33	.50	1.00	.33	.67
	PrTe	1.00	1.00	.67	.33	.50	.50	.33	.33	1.00	1.00	1.00	.67
S_{52}	SpNo	1.00	1.00	.67	.67	.50	.50	.33	.33	1.00	1.00	1.00	.33
	SpTe	1.00	1.00	.67	.67	.50	.00	.67	.67	.50	.50	1.00	.67
	PrNo	1.00	1.00	1.00	.33	1.00	1.00	.33	1.00	1.00	.50	.67	.67
	PrTe	1.00	1.00	.67	.67	.50	.50	1.00	.67	1.00	1.00	1.00	1.00
S_{53}	SpNo	1.00	1.00	.33	.67	.50	.00	.33	.33	1.00	1.00	.67	.67
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.33	.33	.50	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.33	.33	1.00	1.00	.00	.67
	PrTe	1.00	1.00	.33	.67	.50	.50	.33	.00	1.00	1.00	.67	.67
S_{54}	SpNo	1.00	1.00	1.00	.67	.00	.00	.33	.33	1.00	1.00	.67	1.00
	SpTe	1.00	1.00	.67	.67	.00	.00	.67	.67	.50	.50	.67	.67
	PrNo	1.00	1.00	.33	.33	.00	.50	.67	.67	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	.67	.67	.50	.50	.33	.67	1.00	1.00	.67	1.00
S_{55}	SpNo	1.00	1.00	1.00	1.00	.50	1.00	.67	.33	1.00	1.00	.67	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.67	.67	.50	1.00	.67	.67
	PrNo	1.00	1.00	.67	.67	.50	1.00	.67	.67	1.00	1.00	.67	.33
	PrTe	1.00	1.00	1.00	.67	.50	.50	.67	.00	1.00	1.00	1.00	.67
S_{56}	SpNo	1.00	1.00	.67	1.00	.50	.00	.33	.67	.50	.50	.67	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.67	.33	.50	.50	.33	.33
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.33	1.00	1.00	.67	.67
	PrTe	1.00	1.00	1.00	1.00	.50	.50	.00	.33	1.00	1.00	1.00	.67

TRAINED SUBJECTS--Continuted

Subject		Sex Test	Sex Retest	Age Test	Age Retest	Ethnic Group Test	Ethnic Group Retest	Education Test	Education Retest	Phys. Size Test	Phys. Size Retest	Dial. Region Test	Dial. Region Retest
S_{57}	SpNo	1.00	1.00	1.00	1.00	.50	1.00	.67	.67	1.00	.50	1.00	.67
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.67	.67	.50	.50	.33	.33
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.67	.33	1.00	1.00	1.00	.67
	PrTe	1.00	1.00	1.00	1.00	.50	.50	.00	.00	1.00	1.00	1.00	.67
S_{58}	SpNo	1.00	1.00	.67	.67	.50	.50	.67	.67	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	1.00	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.33	.33	1.00	1.00	.33	.67
	PrTe	1.00	1.00	.67	1.00	.50	.50	.00	.67	1.00	1.00	1.00	.67
S_{59}	SpNo	1.00	1.00	.67	1.00	.50	.00	.33	.67	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.33	.67	.50	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	1.00	.50	.00	.67	1.00	1.00	.33	1.00
	PrTe	1.00	1.00	.67	.67	.50	.50	.33	.00	1.00	1.00	.67	.67
S_{60}	SpNo	1.00	1.00	.67	.67	1.00	.50	.33	.67	.50	.50	.67	.67
	SpTe	1.00	1.00	1.00	1.00	.00	.00	1.00	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.33	.50	.50	.33	.67	1.00	1.00	.33	.00
	PrTe	1.00	1.00	1.00	.67	.50	.50	.33	1.00	1.00	1.00	.67	.67
S_{61}	SpNo	1.00	1.00	.67	.67	.50	.50	.67	1.00	1.00	.50	1.00	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.67	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	.33	.33	1.00	1.00	.67	.67	.50	1.00	.00	1.00
	PrTe	.50	1.00	.67	.33	.50	.50	.00	.33	1.00	1.00	.67	.33
S_{62}	SpNo	1.00	1.00	.67	.67	1.00	.50	.67	.33	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	1.00	.67	.50	.00	.67	.33	.50	.50	.67	.33
	PrNo	1.00	1.00	.67	.00	.00	.50	.67	.33	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	.33	.33	.50	.50	.00	.67	1.00	1.00	1.00	.67
S_{63}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.67	.67	1.00	.50	.67	1.00
	SpTe	1.00	1.00	1.00	1.00	1.00	.00	.33	.33	.50	.50	1.00	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.33	1.00	1.00	.33	.00
	PrTe	1.00	1.00	.67	1.00	.50	.50	.33	.67	1.00	.50	.67	1.00

TRAINED SUBJECTS--Continued

Subject		Sex		Age		Ethnic Group		Education		Phys. Size		Dial. Region	
		Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest	Test	Retest
S_{64}	SpNo	1.00	1.00	.67	.67	.00	.50	.67	.67	1.00	1.00	.67	.67
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.67	.67	.50	.50	.33	.67
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.67	.50	.50	.67	.67
	PrTe	1.00	1.00	.67	1.00	.50	.50	.33	.67	1.00	1.00	.67	.33
S_{65}	SpNo	1.00	1.00	.67	.67	.50	.00	.67	.67	1.00	1.00	.33	.33
	SpTe	1.00	1.00	.67	.67	.00	.00	.67	.33	.50	.50	.67	.67
	PrNo	1.00	1.00	.67	.67	1.00	1.00	.33	.33	1.00	.50	.33	.67
	PrTe	1.00	1.00	.67	.33	.50	.50	.33	.00	1.00	1.00	.67	1.00
S_{66}	SpNo	1.00	1.00	.67	1.00	.50	.00	.67	.33	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	1.00	.33	.50	.50	.33	.33
	PrNo	1.00	1.00	.33	.67	1.00	1.00	.67	.67	1.00	1.00	.67	1.00
	PrTe	1.00	1.00	1.00	.67	.50	.50	.67	.33	1.00	1.00	1.00	1.00
S_{67}	SpNo	1.00	1.00	1.00	1.00	.50	.50	.67	.33	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	1.00	1.00	.00	.00	.67	.67	.50	.50	.67	.33
	PrNo	1.00	1.00	.67	.67	.50	.50	.67	.67	.50	1.00	.67	.67
	PrTe	1.00	1.00	1.00	1.00	.50	.50	1.00	.33	.50	1.00	.67	.67
S_{68}	SpNo	1.00	1.00	.67	1.00	.50	.50	.67	.67	1.00	.50	1.00	.67
	SpTe	1.00	1.00	1.00	.67	.00	.00	.67	.67	.50	.50	.67	.33
	PrNo	1.00	.50	.33	.33	.50	.50	.67	.33	1.00	.50	.33	.33
	PrTe	1.00	.50	1.00	.67	.50	.50	.33	.00	.50	1.00	.67	1.00
S_{69}	SpNo	1.00	.50	.67	.67	.50	.50	1.00	.67	1.00	1.00	1.00	1.00
	SpTe	1.00	1.00	.67	1.00	.50	.00	.33	.33	.50	.50	.33	.33
	PrNo	1.00	1.00	.67	.67	.00	.50	.67	.67	1.00	1.00	1.00	1.00
	PrTe	1.00	.50	1.00	1.00	.50	.50	.33	.33	1.00	1.00	1.00	.67

APPENDIX H

PROPORTION CORRECT OVER ALL SPEAKER CHARACTERISTICS FOR THE TRAINED AND UNTRAINED GROUPS UNDER THE SPEECH TREATMENT COMBINATIONS FOR THE TEST AND RETEST CONDITIONS

UNTRAINED SUBJECTS--FIVE SECOND SPEECH SAMPLES

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_1	.6383	.6383	.6950	.6950	.8883	.7500	.8333	.8350
S_2	.6383	.6683	.7233	.8067	.5817	.8333	.7500	.8050
S_3	.4433	.5817	.5567	.6100	.5267	.6383	.6950	.7500
S_4	.7233	.7500	.7783	.8617	.8333	.5833	.7500	.7500
S_5	.4983	.5817	.6667	.6117	.6950	.7500	.8050	.8050
S_6	.7500	.6117	.7500	.6933	.6933	.7517	.8900	.7500
S_7	.6117	.5850	.8067	.9450	.6100	.7500	.8050	.8883
S_8	.6933	.6383	.7783	.6950	.6383	.7500	.8617	.6383
S_9	.3883	.6383	.6400	.6950	.5833	.6667	.6383	.5283
S_{10}	.6950	.8067	.6683	.5833	.7500	.6950	.6117	.6100
S_{11}	.6400	.5817	.6383	.6950	.5550	.6383	.6950	.6383
S_{12}	.5550	.6117	.6950	.6383	.6667	.7217	.6383	.6400
S_{13}	.6667	.7500	.7517	.5550	.8350	.7500	.8067	.7217
S_{14}	.6117	.5567	.6683	.6933	.5000	.5550	.8050	.7233
S_{15}	.6117	.6933	.8067	.8067	.5850	.5000	.6400	.7500
S_{16}	.6950	.6950	.6383	.6950	.8900	.6950	.6683	.7500

UNTRAINED SUBJECTS--FIVE SECOND SPEECH SAMPLES--Continued

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_{17}	.5567	.5267	.6667	.6383	.7500	.7783	.6400	.6400
S_{18}	.5283	.5567	.7217	.6667	.6950	.6100	.6117	.6950
S_{19}	.5000	.6400	.7783	.7233	.7767	.5283	.6683	.8617
S_{20}	.5267	.5833	.5817	.5817	.4983	.4433	.8617	.7500
S_{21}	.5550	.5000	.6383	.6950	.6383	.6683	.8617	.7783
S_{22}	.6117	.6950	.6383	.6683	.6933	.6667	.6117	.6950
S_{23}	.5833	.8067	.4983	.5850	.5550	.4717	.6950	.8067

UNTRAINED SUBJECTS--TEN SECOND SPEECH SAMPLES

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_1	.8900	.8067	.7500	.8900	.6950	.6383	.7517	.6950
S_2	.8350	.8617	.7217	.9450	.7500	.7500	.7517	.7517
S_3	.8883	.7500	.9450	1.0000	.8067	.6950	.6667	.8050
S_4	.8333	.6687	.8350	.8883	.7783	.6950	.7500	.7500
S_5	.7217	.7500	.8067	.8617	.6950	.4717	.8350	.6117
S_6	.6933	.6933	.8617	.8883	.6383	.6950	.8067	.7500
S_7	.6100	.7233	.8883	1.000	.6933	.5550	.6683	.8050
S_8	.7517	.8617	.8050	.9450	.7500	.6950	.6950	.7517
S_9	.7217	.7517	.9450	.7233	.6100	.7233	.6683	.6950
S_{10}	.5567	.7500	.8883	.8333	.6950	.6933	.6683	.6683
S_{11}	.7500	.7500	.7500	.7783	.6950	.5817	.8067	.7517
S_{12}	.7500	.6933	.8883	.8617	.7783	.6400	.8067	.8067
S_{13}	.6950	.6950	.8883	.8333	.7783	.8067	.7500	.6383
S_{14}	.7500	.7517	.8617	.9450	.7767	.7500	.8333	.7783
S_{15}	.7217	.8050	.8333	.9450	.8333	.7500	.7517	.6117
S_{16}	.7500	.7217	.9450	.8900	.8333	.8067	.6400	.7500

UNTRAINED SUBJECTS--TEN SECOND SPEECH SAMPLES--Continued

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_{17}	.7500	.7500	.7783	.8050	.8333	.8617	.8617	.7500
S_{18}	.8050	.7500	.8333	.8333	.7783	.7517	.7517	.6950
S_{19}	.5550	.6100	.8883	.9450	.7217	.6400	.7500	.7500
S_{20}	.6933	.5283	.7783	.8900	.8350	.6667	.6667	.6667
S_{21}	.8333	.6950	.8333	.7767	.6383	.6100	.6383	.8067
S_{22}	.6100	.7500	.8617	.8883	.6400	.6950	.7517	.7517
S_{23}	.7217	.7217	.8067	.8333	.6383	.7500	.7517	.7500

UNTRAINED SUBJECTS--FIFTEEN SECOND SPEECH SAMPLES

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_1	.7783	.6950	.6400	.5833	.6667	.8900	.6950	.6383
S_2	.8067	.8067	.5283	.4167	.7233	.8900	.8067	.5283
S_3	.6383	.6667	.6100	.5833	.7517	.7500	.6117	.8050
S_4	.7233	.8333	.5567	.7233	.6683	.8900	.6400	.7783
S_5	.6667	.6383	.6383	.6950	.7500	.7517	.6400	.7517
S_6	.6117	.6400	.4717	.3600	.6683	.7500	.6933	.5000
S_7	.5267	.5267	.7500	.6950	.7500	.8067	.7517	.7517
S_8	.8883	.6667	.6667	.5550	.6100	.6683	.6400	.6933
S_9	.6117	.5283	.5850	.6950	.7783	.6383	.6933	.5833
S_{10}	.7783	.7217	.5833	.5283	.8067	.8067	.7500	.7500
S_{11}	.6383	.6100	.6400	.5850	.6950	.8350	.6383	.6683
S_{12}	.5267	.6683	.5833	.6383	.6400	.7500	.5833	.5000
S_{13}	.7217	.6385	.6383	.6400	.8067	.6950	.7500	.7500
S_{14}	.6383	.5833	.6400	.6950	.7783	.8350	.6400	.6950
S_{15}	.5267	.7500	.5550	.6117	.7783	.6683	.6950	.6950
S_{16}	.5550	.6667	.6950	.5833	.8350	.8900	.6950	.7500

UNTRAINED SUBJECTS--FIFTEEN SECOND SPEECH SAMPLES--Continued

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_{17}	.6117	.5283	.5567	.6400	.6400	.7517	.5833	.6950
S_{18}	.5550	.6667	.5550	.5550	.6950	.5550	.5267	.6950
S_{19}	.6667	.7217	.5833	.5850	.6950	.8067	.6400	.7500
S_{20}	.6667	.7217	.7500	.6400	.7783	.5550	.6950	.6383
S_{21}	.8050	.6667	.4450	.6400	.6667	.8067	.6383	.8067
S_{22}	.8617	.7500	.7783	.6950	.6117	.6950	.8067	.7500
S_{23}	.6667	.5267	.7500	.7783	.6950	.8350	.5833	.8067

TRAINED SUBJECTS--FIVE SECOND SPEECH SAMPLES

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_1	.6383	.7500	.8350	.8617	.7500	.6667	.7517	.8617
S_2	.7500	.6950	.8067	.6383	.7500	.8617	.8900	.8050
S_3	.5550	.5833	.8067	.7500	.6117	.6100	.8617	.7500
S_4	.5267	.6400	.8067	.7500	.6383	.8350	.6950	.7517
S_5	.6950	.5267	.8050	.6683	.7500	.8333	.6950	.8050
S_6	.7500	.6667	.6400	.5567	.6400	.5550	.8617	.8617
S_7	.6383	.5833	.7517	.6667	.6667	.7233	.8067	.5567
S_8	.7233	.5550	.6400	.6667	.6117	.6100	.9167	.8067
S_9	.6117	.6683	.8900	.6950	.5000	.6383	.7217	.7217
S_{10}	.4433	.5000	.7517	.7233	.7767	.7767	.7233	.6683
S_{11}	.5550	.5550	.5000	.7517	.7783	.8333	.6667	.6667
S_{12}	.8900	.6950	.7500	.6117	.6117	.7500	.8617	.8050
S_{13}	.6950	.6933	.8333	.5833	.7217	.6650	.8067	.8067
S_{14}	.6100	.6117	.6950	.6950	.8350	.6383	.9167	.7500
S_{15}	.5833	.6383	.7233	.7233	.6650	.7783	.6950	.6950
S_{16}	.6383	.5833	.7783	.6667	.6667	.6667	.6933	.7500

TRAINED SUBJECTS--FIVE SECOND SPEECH SAMPLES--Continued

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_{17}	.6667	.6667	.6100	.6100	.5817	.6383	.7500	.7500
S_{18}	.6950	.6950	.3600	.5000	.6650	.6383	.9167	.6117
S_{19}	.5000	.5000	.8067	.8900	.5833	.8050	.8617	.6950
S_{20}	.8067	.5833	.6383	.6383	.8900	.9450	.7783	.7233
S_{21}	.5550	.5567	.8067	.7233	.6950	.6683	.7217	.8617
S_{22}	.5550	.6117	.8350	.6683	.5550	.6683	.7500	.8050
S_{23}	.6383	.5833	.8067	.6383	.7517	.6933	.8617	.8067

TRAINED SUBJECTS--TEN SECOND SPEECH SAMPLES

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_1	.7500	.7783	.7783	.7783	.7517	.6383	.6383	.7500
S_2	.8067	.8883	.7783	.7217	.5000	.6950	.5817	.6100
S_3	.7783	.8333	.8333	.8333	.7783	.9450	.8067	.8067
S_4	.7500	.8617	.6400	.8333	.6667	.6950	.6383	.5550
S_5	.6683	.7500	.8067	.8883	.7767	.7767	.6400	.7500
S_6	.6667	.7783	.8333	.8900	.8350	.8067	.6117	.7767
S_7	.8617	.8067	1.0000	.8900	.8067	.8067	.7500	.6933
S_8	.6950	.5550	.6667	.7233	.6933	.8900	.6950	.6950
S_9	.6400	.6667	.8333	.7783	.6383	.6950	.7500	.6950
S_{10}	.9450	.9450	.8333	.8333	.9167	.9167	.8067	.8067
S_{11}	.8067	.6950	.8900	.8350	.6667	.7233	.6950	.5817
S_{12}	.8617	.8067	.8333	.8333	.8617	.8617	.6950	.7500
S_{13}	.7500	.8067	.8900	.9450	.8900	.8067	.6383	.7517
S_{14}	.8067	.6950	.9450	.7500	.7517	.7500	.6950	.8067
S_{15}	.6383	.7767	.8317	.7500	.8050	.6383	.6667	.7500
S_{16}	.7783	.8333	.5833	.8333	.8050	.7500	.6117	.7517

TRAINED SUBJECTS--TEN SECOND SPEECH SAMPLES--Continued

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_{17}	.7500	.7217	.8333	.7500	.8067	.6950	.7217	.5550
S_{18}	.8067	.8067	.8333	.8900	.8617	.8067	.7500	.6933
S_{19}	.6100	.6383	.8333	.7783	.6950	.6950	.6383	.6667
S_{20}	.5833	.6667	.6383	.7217	.6933	.8333	.6117	.8067
S_{21}	.7517	.7517	.8067	.8050	.8617	.8067	.6683	.8067
S_{22}	.6933	.7783	.8333	.8333	.8067	.9167	.8617	.6950
S_{23}	.8900	.9450	.7500	.8333	.6400	.6117	.6950	.7783

TRAINED SUBJECTS--FIFTEEN SECOND SPEECH SAMPLES

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_1	.6950	.6117	.6667	.5283	.7783	.5550	.6933	.8067
S_2	.8617	.7783	.6950	.6950	.6117	.8333	.6950	.8067
S_3	.8067	.5000	.4167	.5567	.7500	.7217	.6950	.7783
S_4	.8067	.6117	.5267	.5833	.8617	.8350	.7517	.8050
S_5	.5550	.7233	.5833	.5283	.6383	.7783	.7500	.6383
S_6	.7500	.6383	.7233	.5850	.8333	.7500	.8617	.8067
S_7	.6383	.6177	.6383	.5833	.6667	.6950	.6383	.6400
S_8	.6667	.6667	.5850	.5850	.6117	.7500	.6950	.8067
S_9	.8067	.8883	.6400	.7233	.7517	.7783	.8617	.6400
S_{10}	.6117	.6950	.5833	.5267	.7517	.6950	.7500	.7500
S_{11}	.8617	.8067	.5833	.5833	.8900	.7783	.7500	.6950
S_{12}	.8067	.7233	.6950	.5833	.7217	.6950	.6950	.8067
S_{13}	.7500	.7783	.6383	.6400	.6667	.8067	.6950	.6400
S_{14}	.6950	.6683	.6950	.5833	.6383	.5833	.7500	.8067
S_{15}	.8067	.7783	.6400	.5833	.5833	.8333	.5567	.5817
S_{16}	.8900	.7500	.7233	.4717	.6683	.6383	.6383	.6950

TRAINED SUBJECTS--FIFTEEN SECOND SPEECH SAMPLES--Continued

Subject	Spontaneous Test	Normal Retest	Spontaneous Test	Telephone Retest	Prepared Test	Normal Retest	Prepared Test	Telephone Retest
S_{17}	.8067	.7783	.8050	.5833	.6950	.5833	.6950	.7783
S_{18}	.6683	.7517	.5833	.6400	.6683	.6117	.6950	.7500
S_{19}	.6950	.6117	.5850	.5283	.7217	.6950	.6950	.6383
S_{20}	.8067	.7217	.6383	.5267	.7783	.8900	.8617	.7500
S_{21}	.8617	.8050	.6400	.5833	.6683	.7517	.7783	.7500
S_{22}	.8067	.7233	.6400	.5283	.6383	.4150	.6667	.6117
S_{23}	.8617	.7233	.5550	.5267	.7233	.8067	.8050	.6667