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THE EFFECT OF TECHNICAL QUALITY DEFICIENCIES
ON COMPREHENSION AND SOURCE CREDIBILITY

BY

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B.S.B.A., Florida Technological University, 1970

THESIS

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Orlando, Florida

118408

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CHAPTER I

INTRODUCTION AND BACKGROUND

The present standards of technical quality in audio production have been set by tradition and subjective analyses. If one fails to adhere to these standards, what will result? If one allows too much of some undesirable element to creep into a production, will the functionality of that production be diminished? If this type of quality deficiency does affect the aesthetic function of a presentation, does it also affect other functions, such as an informative function? A survey of previous research has not found studies addressing these questions. Any answers which are available are not the product of empirical evidence. With this problem in mind, the present study makes no hypotheses but simply asks the research question: What effect does the lack of technical quality have on the listener's learning the presented material?

One might begin to answer this question by investigating the somewhat ambiguous state known as "quality." The words shows up with dull regularity in audio production and radio/television texts, yet despite the constant mention of the sought-after state of quality, only tradition and subjective analysis define the parameters of "quality." More importantly, there is an equal lack of empirical research concerning the effect of quality.

From an aesthetic viewpoint, the case for high quality can be made using the classic aesthetic goal of recording: to reproduce as

accurately as possible the original sound source. Thus, any introduction of elements such as system noise or distortion would be an introduction of something not within the original sound. The resulting lack of faithfulness in the reproduction would detract from the aesthetic quality of the recording.

With sound sources such as symphonic music, the purpose of recording is to allow the home listener, as accurately as possible, to simulate having been in the concert hall for the performance. In such an instance, quality and function become synonymous and any lack of quality has a direct effect on the function of the recording.

In educational presentations, the sound source is often an aural presentation designed to inform or persuade. In this case the function of the recording is to inform or persuade. With such a setting one cannot correlate lack of faithful reproduction, or quality, with diminishing functionality of the presentation. If the purpose of the speech is to inform, then inaccurate reproduction becomes a functional problem when it reaches the point where the ability of the presentation to inform the listener is impaired.

This is especially interesting because the field of educational recording, which concentrates mainly on informative presentations, exhibits perhaps the greatest range of quality. Educational presentations are produced in a wide range of facilities having a wide range of production budgets. Hence, in the realm of educational recordings, one might find some producers, those with the resources, spending a great deal of time and money in pursuit of perfect aesthetic quality in recording. Likewise, other producers, those with minimal resources, may

spend very little on quality and thus produce recordings which are low on aesthetic quality. The question is, from a functional point of view, who is right? Is the perfectionist wasting resources striving for high quality when perhaps a lower level of quality would be equally functional? Is the individual who does not have the capabilities to produce high aesthetic quality destined to achieve presentations which are less functional? The present study seeks to shed some empirical light on this problem.

If quality variables have a pronounced effect on various function variables, then it would be conceivable that, after much further research, a set of quality standards could be established so that quality could be defined and measured with some degree of objectivity. The producer could know what level of quality would be necessary for a specific purpose. If quality variables prove to have little or no effect on function variables, one would want to make some production decisions in a different light. The producer, if confronted with a quality problem, would be in a better position to decide what effect this problem will have on the functionality of the presentation.

The present study does not answer all these questions but it begins to seek the answers in terms of specific variables.

A. Independent Variables

1. Noise

The dictionary defines noise as "in audio, acoustics, etc., any sound that interferes with the sound impulse being communicated."¹ Alec Nesbitt, in his audio production text, Technique of the Sound Studio,

provides a rather lengthy definition of noise, including such points as ". . . unwanted electrical hiss . . . hum or unwanted electromagnetic noise . . ." ² Nesbitt goes on to say that ". . . it is vital in radio and recording work to preserve an adequate signal-to-noise ratio at every stage." ³ Colby Lewis speaks of "spurious noise" which is generated by the reproducing systems coming into competition with the program sound. ⁴

From these citations it becomes evident that "noise" in audio production is something audible which was not intended, not wanted and generally considered not desirable. Of course, the noise spoken of above is system noise, noise originated in the audio system, as opposed to acoustical background noise such as wind noise, motor noise, stage noise, and the like.

In his discussion of production quality, Nesbitt mentions system noise as a definitely negative factor. He further mentions two types of system noise, "random sound of indefinite pitch" and a "form of noise which has a definite pitch, . . . hum." ⁵

Noise with random frequency qualities may be either "white noise" which contains all frequencies in equal proportion, or "colored noise," which exhibits some frequencies at higher levels than others. ⁶ Because a specific shading of colored noise may be rather hard to define, white noise, which is a relatively definite concept, will be used in the present study as the example of noise of random frequencies and indefinite pitch.

Hum is generally the result of the frequency of the A.C. power source getting into the audio signal. ⁷ This means that the fundamental alternating current frequency (60 Hz in the United States) and its

harmonics are carried with the program audio, producing an audible, low-pitched tone. Although the tonal characteristics of hum may vary somewhat with the amount of audible harmonics, the present study considers a 60 Hz sine wave tone as the representative of audio system hum.

When experimenting with noise, one must decide at what level, in proportion to the program audio, the noise should be presented. The rationale for this decision is discussed in the pilot study section. For the purposes of this experiment, however, the noise is not introduced in such a way that the program audio is masked or in any way rendered unperceivable. A program-to-noise ratio is established at which the noise competes with the program but does not mask the program out.

2. Distortion

Another element that has been traditionally regarded as a nemesis in audio recording is distortion. Oringel defines distortion simply as "an undesirable alteration of sound."⁸ Nesbitt refers to distortion as "unwanted changes in sound quality."⁹ He goes on to explain that distortion is often caused when at any point in the audio chain the volume is too high for the stage that follows.¹⁰ In simpler terms, the various amplifiers in an audio system are designed to operate with signal of a certain volume, or amplitude. When this level is exceeded, the amplifiers can no longer process the sound accurately. If certain peaks in the wave form of the audio are too great for the amplifier to handle, these peaks will be clipped off, thus causing the wave form to have flattened peaks. This clipping produces new tones in harmonics of the original tone which, when added to the original audio, now also lacking

in peaks, produces a generally undesirable sound. Harmonic distortion of this variety is generally not too noticeable at the one or two per cent level; however, Nesbitt cites one per cent as a "reasonable limit for high quality."¹¹

For the purposes of the present experiment, a much higher level of distortion is used. As with noise, the level of the distortion is not high enough to render the subject matter indiscernible. The treatment consists of distortion audible to the untrained listener.

B. Dependent Variables

1. Comprehension

The present study examines independent variables which have not been previously tested with regard to their effect on listener comprehension. Although no previous experiments are directly analogous to the present study, there are numerous experiments reported which study the effects of other variables on listener comprehension. A review of these works can provide the knowledge of the various elements which have been identified as factors of comprehension necessary to the researcher in developing an experimental design which eliminates, as much as possible, any contamination by uncontrolled variables.

Charles Petrie, Jr., published a summary of research on informative speaking in 1963. Petrie provided a good organizational scheme for a presentation of these studies by dividing the independent variables into four categories: the Message, the Speaker, the Listener, and the Environment.¹² Petrie notes that "since the effectiveness of an informative speech is measured in terms of the degree to which the subject

matter is comprehended, research in informative speaking is also research in listening comprehension."¹³

Variables of the message are first in Petrie's discussion. As is much of the research in comprehension, some of the research in message variables is somewhat conflicting. For instance, relationships between readability, clarity, listenability, and comprehension have yet to be established. Although several studies have been done, this area remains undefined due to conflicting results.¹⁴ Petrie does find evidence that "easy messages are more readily comprehended than "difficult" messages.¹⁵ Although these terms are by nature somewhat vague, research such as K. C. Beighley's 1954 study indicates that comprehension of "easy" material is significantly higher than comprehension of "difficult" material.¹⁶

Verbal emphasis, such as repetition and proactive emphases, and good development of main ideas seem to be two other positive factors of comprehension. Studies by Brown,¹⁷ Pence,¹⁸ Ehrensberger,¹⁹ and others²⁰ show the value of emphasis, while the Blewett,²¹ Spache,²² and Trenaman²³ studies substantiate the rhetorical principle that a good speech is developed around a few well-developed main ideas.²⁴

Organization is perhaps the most researched element of the message. Petrie cites over twenty studies on various effects of organization and yet in the light of conflicting results concludes that "experimental evidence is inconclusive about the role of speech structure [organization] in informative speaking."²⁵ Subsequent research seems to have clarified the situation somewhat. Darnell's 1963 study showed significant decreases in comprehension of disorganized messages.²⁶

Thompson, whose 1960 study was included by Petrie, conducted another experiment, published in 1967, which also showed significant decreases in comprehension of disorganized messages.²⁷ McCroskey, citing Thompson, Darnell, and others in his 1972 speech text, concludes that "good organization . . . is important to the success of communicators, whether they have persuasive intent or informative intent."²⁸

Another recent study by Ernest examined the effect of various types of message material (general, historical or technical) and the difficulty of the material as factors of comprehension. The effect of these variables alone provides no significant differences although combined with a high rate of presentation (160 wpm) differences in the comprehension of the various types of message materials were found.²⁹

"The Speaker" is Petrie's second category of comprehension variables. Under this category fall two topics which have inspired considerable research: source credibility and delivery.

Source credibility, while an important factor in persuasive speaking,³⁰ has not been established as a dominant factor in comprehension. Petrie sums up Hovland, Janis, and Kelly;³¹ Paulson;³² Hildreth;³³ Gilkinson, Paulson, and Sikkink;³⁴ and others, by stating, "most investigators report that source credibility, source sincerity, and the audience's like or dislike for the speaker have no effect upon the listener's comprehension of the message."³⁵ Other research by Hovland and Weiss³⁶ and subsequent research by Tomkins and Samovar³⁷ and by Schweitzer³⁸ all confirm previous research with nonsignificant differences in comprehension of high and low ethos sources. McCroskey also reports the lack of experimental evidence linking source credibility with comprehension. He does,

however, go on to advise the speech student "to refrain from concluding that ethos has no effect in informative communication." McCroskey feels subjectively that "there is substantial reason to believe that ethos does have a significant impact on learning in spite of the research findings to the contrary."³⁹

Delivery variables seem to be the more dominant aspect of the speaker's effectiveness although much of the research is not totally conclusive. Petrie cites studies by Weissman and Klower, Phillips and Koepfel which report significantly greater comprehension from "good" (as opposed to "poor") speakers.⁴⁰ Beighley also reports a significantly higher immediate recall of facts presented by skilled speakers.⁴¹ McCroskey concurs with Beighley and a subsequent study by Leitner, concluding that "good delivery" will tend to enhance communication designed to influence audience understanding.⁴² Other delivery variables reported by Petrie are formal versus conversational modes, vocal quality, rate, emphasis, eye contact, and visible action in delivery. Mode of delivery was found to be an unclear area by Petrie⁴³ although at least one subsequent study found the dynamic style to be significantly more comprehensible than the static, or undynamic, style.⁴⁴ Moderately poor voice quality, including poor pitch and nonfluency, appeared to have no effect on comprehension according to Petrie,⁴⁵ and a subsequent study by Kibler and Barker, using mispronunciation as a variable, also yielded nonsignificant results.⁴⁶

Rate is an interesting delivery variable in that while older studies show losses of comprehension at speech rates which are too high or low,⁴⁷ recent studies using automatic time-compression devices have

enables experimenters to increase speech rate without affecting comprehension. Five studies at the time of Petrie's⁴⁸ writing and at least one subsequent study⁴⁹ indicate that effective rates of speech can now be increased to a much higher rate than was previously considered "optimal."

Emphasis of important points is another gray area in comprehension research. Petrie cites studies with conflicting results from raising the voice for certain points.⁵⁰ A study by Baron, involving electronic emphasis of specific passages, showed significant results from increasing the volume of selected passages four decibels.⁵¹

Visible action and use of visual aids is one area of delivery which produces some consistency in experimental results. Several studies cited by Petrie⁵² reported visual elements as significantly positive factors in comprehension. McCroskey also stated that the use of visuals was "one area of research relating to informative communication which has provided relatively unequivocal results . . . the rhetorical communicator who hopes to increase his audience's understanding should consider the use of visual aids."⁵³

Eye contact is given some importance by Petrie;⁵⁴ however, in the electronic media, one subsequent study by Tiemans produced no significant differences in recall of information presented on video tape at various camera angles.⁵⁵

It is interesting to note that although some of the delivery variables yielded conflicting or nonsignificant results, these same variables, including eye contact, volume, pitch, rate, articulation, fluency, emphasis, and bodily action are listed by McCroskey as "elements of good delivery." It would seem that although the experimental evidence is not

yet significant in some areas, there is sufficient subjective basis to acknowledge the possible effects of these variables.⁵⁶

Environment variables are the most ignored area of comprehension research. Petrie, on the basis of only five studies, was forced to conclude that "the limited experimental evidence available suggests that the physical environment may not significantly influence listening comprehension."⁵⁷ Subsequent research is also scarce, although one study using the television medium found no significant differences in comprehension when irrelevant video cues in the form of production flaws were inserted in the presentation.⁵⁸

The area of listener variables is perhaps the most interesting yet the most perplexing. Although experiments indicate that listener variables may be working in speech situations, very little information has been ascertained as to the specific variable or interactions of variables that are most effective. Sex, personality, intelligence, scholastic achievement, verbal ability, vocabulary, experience, motivation, attitude and organizational ability have all been experimented with yet with the possible exception of the general positive relationship to organizational ability, all experiments were plagued with weak correlations, conflicting results, nonsignificance, or operational problems.⁵⁹ The fact that there may be several variables operating in all speech experiments which we know very little about could cause significant operational problems.

One may conclude that there are indeed a great many comprehension variables, many of which are not yet understood. Learning which variables can be predicted is vital to any research in comprehension but

perhaps even more important should be the effort to identify other possible variables, even if their operation is still somewhat doubtful or mysterious, so that these variables can be controlled as much as possible to reduce experimental contamination. This is especially true of the listener and environmental variables since they are presently the least predictable.

2. Source Credibility

What Aristotle called ethos, we know variously as source credibility, prestige, personal proof or attitude toward the source. It is defined by Anderson and Clevenger as "the image held of a communicator at a given time by a receiver."⁶⁰ The present study will use the term "source credibility" as the nomen for this concept.

Aristotle stated that the speaker's "character [ethos] is the most potent of all means of persuasion."⁶¹ More than twenty-two hundred years later James McCroskey stated that "of all the aspects of classical rhetorical theory, the one that has the greatest support from modern empirical research is the theoretical importance of ethos in communication."⁶² The fact that source credibility has an effect on the persuasiveness of a communication was well-founded in empirical research by 1963, when Anderson and Clevenger published their comprehensive summary of experimental research in ethos.⁶³ It was not until more recently, however, that source credibility became a popular dependent variable, especially as an effect of delivery variables.

Traditional elements of "good" delivery such as eye contact, voice quality, speech rate, articulation, fluency, and bodily action

have all been studied as possible functions of comprehension.⁶⁴ Many of these same variables have been studied with regard to their effect on source credibility ratings.

One of the more prolific examples is nonfluency. Miller and Hewgill published an article on the effect of various levels of two types of nonfluency on audience ratings of source credibility in 1964. They found that nonfluent speech had a significantly negative effect on the audience ratings of the speaker's competence and dynamism, although the trustworthiness dimension of the source credibility scales yielded non-significant differences.⁶⁵ A later study by Sereno and Hawkins yielded very similar results using additional types of nonfluency and essentially the same dependent scales.⁶⁶ In 1969, McCroskey and Mehrley again found nonfluency to be a significant factor in audience ratings of speaker source credibility.⁶⁷ McCroskey also reported that, in previous studies of his own, other delivery variables including "gesture, movement, facial expression, eye contact, vocal rate, inflection and nonfluency" were manipulated, the overall effect being that "poor" delivery resulted in lower credibility ratings.⁶⁸ Seiler found that use of visuals in a speech presentation was another positive factor in credibility ratings.⁶⁹

Although organization is primarily a message variable, it is often studied in conjunction with delivery. Sharp and McClung, studying the effect of organization on source credibility ratings, found that a disorganized presentation could lower the credibility of an initially high ethos source.⁷⁰ Disorganization was also shown to be a significant negative factor by McCroskey and Mehrley.⁷¹

While some studies have been reported on the relationship of environmental variables on comprehension, none address themselves to the possible effect of environmental variables on ethos ratings. While one might say that by all rights the surroundings of the communicative act should have no significant effect on the audience's opinion of a communicator, neither should delivery have such an effect. As Aristotle wrote, "delivery is regarded as something vulgar . . . the case should, in justice, be fought on the strength of the facts alone."⁷² Yet, justice aside, he recognized twenty-two centuries ago that "success in delivery is of the utmost importance to the effect of a speech."⁷³ McCroskey states, in more contemporary language, that "delivery should not make a difference. But it does make a difference, and therefore we must study it."⁷⁴

Whether technical flaws in a communication system are considered part of the delivery or part of the environment of the communicative act is perhaps open to debate, but this makes little difference for the important issue is that such factors are part of the total communicative perception of the audience and should therefore be considered. Again quoting Aristotle, "external matters do count for much, because of the sorry nature of the audience."⁷⁵ Although the realm of "external matters" has certainly increased since Aristotle's time, the basic concept may well hold true in today's multi-media world. With this in mind, the present experiment attempts to see whether the audience is by nature sorry enough to perceive the speaker as less credible because of technical flaws over which he has no control.

In the simplest terms, the present study examines the effect of hum, white noise and distortion on the comprehension and source credibility of a recorded informative presentation, the purpose being simply to determine if the manipulated elements have any significant effect on those variables.

FOOTNOTES

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CHAPTER II

METHODOLOGY

A. Control of Listener Variables

Since the previous listening comprehension research indicated that many variables may be operant in the listening process, careful controls to minimize the possibility of outside contamination had to be taken in the present experiment. One area which Petrie and others pointed out was that of listener variables.¹

There are numerous listener variables mentioned in the previous chapter, many of which have not yet been well defined. The most suitable method of controlling all of these variables was to incorporate a measure of listening ability which measured listening comprehension directly with all its hidden variables, rather than to attempt a dichotomization of these variables and test separately for each one. The latter method would not only be procedurally infeasible but with the limited amount of previous research on these variables, such an attempt would be destined to invalidity.

Two standardized tests for listening comprehension are available. One is the Brown-Carlson Listening Comprehension Test, published by World Book Company; the other is Sequential Tests of Educational Progress (STEP): Listening, published by the Educational Testing Service.²

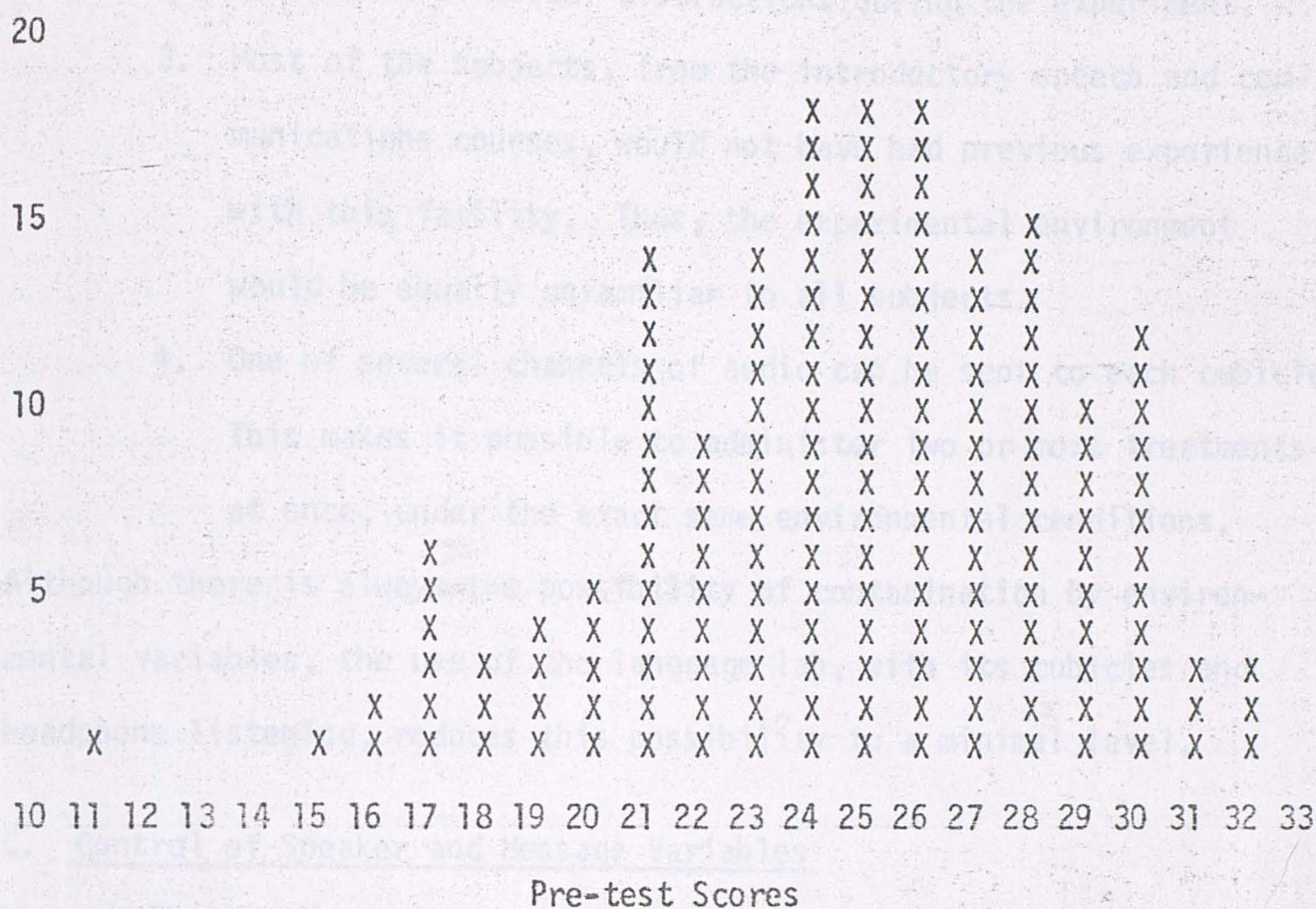
Because of availability, the latter was chosen. The STEP listening test has two forms available for use with freshman and sophomore college

students. The first half of Form 1B was used as the measure of listening ability for the present experiment.

This part of the test consists of six selections which are to be read aloud by the test administrator. Each selection was less than five minutes in length. The subjects have no script and can gain information about the selections only by listening. After each selection, the administrator reads several comprehension questions. The subjects' test booklets consist of the answer choices to these questions. After reading each question once, the administrator pauses to allow the subjects to select their answer choices and indicate their responses on answer sheets. The instructions, selections, and questions to be used in the listening comprehension pre-test were read by a trained narrator and tape-recorded. Adequate time was allowed for the responses to each question. An exact script with time durations is given in Appendix A. One hundred seventy-three subjects from speech and communications classes at Florida Technological University were given the comprehension pre-test. The tests were administered by tape recorder during normal class periods.

Of 36 possible correct answers, scores ranged from 11 to 32 correct, with a mean score of 24.64. As indicated in Figure 1, the scores fell into a relatively normal distribution around the mean; the standard deviation was 3.8833. This data was later used to ensure equality of listening ability among the experimental groups.

Figure 1--Frequency Histogram of Entire Pre-Test Sample

 $N_t = 173$

Mean = 24.6416

Standard Deviation = 3.8833

B. Control of Environmental Variables

Since there is evidence that environmental variables may have effects on comprehension,³ these also should be controlled as much as possible. It was for this reason that the language lab at Florida Technological University was chosen as the site for the final experiment. Several factors provide environmental control.

1. The lab is equipped for headphone listening, thus effectively eliminating interference from outside (acoustic) noise.

2. Each subject is seated in a semi-cubicle, thus decreasing the chance of visual distractions during the experiment.
3. Most of the subjects, from the introductory speech and communications courses, would not have had previous experience with this facility. Thus, the experimental environment would be equally unfamiliar to all subjects.
4. One of several channels of audio can be sent to each cubicle. This makes it possible to administer two or more treatments at once, under the exact same environmental conditions.

Although there is always the possibility of contamination by environmental variables, the use of the language lab, with its cubicles and headphone listening, reduces this possibility to a minimal level.

C. Control of Speaker and Message Variables

The speaker and message variables are relatively simple to control. One merely uses the same speaker and the same message for each treatment with only the independent variables changing.

In the present experiment, two speakers were used. One speaker, a trained announcer who had read the passages for the STEP pre-test, read the instructions and questions, and another speaker, also experienced but one whom the subjects had not heard previously, read the treatment passages. All recording was done on top quality professional recording equipment.⁴ The recording was done on multitrack equipment so as to minimize the generation loss in the final product and simplify the process of editing. The instructions, messages, and treatments were each on separate tracks, enabling a "mix" to be made using any one of the treatments

but leaving all other elements constant.

The two treatment messages were chosen from STEP listening test Form 1A. The first selection was approximately 680 words in length and was read at an approximate rate of 170 words per minute (4 minutes, 0 seconds for the whole selection). The subject was semantic change and was written as an informative presentation in lecture form. The second selection was approximately 450 words in length and again took the form of a lecture-type informative presentation. The approximate reading speed was 130 words per minute (3 minutes, 36 seconds duration). Transcripts of both selections are included in Appendix B. Editing was performed to remove all nonfluencies from the readings. Because the same recordings of the treatment messages were used in all treatment conditions, there were no differences in the messages or the speakers' performance.

D. Manipulation of Independent Variables

The experimental goal is, of course, to hold all variables constant except the independent variables. Thus, even more important than holding all other variables constant, it is of the utmost importance to ensure that the independent variables do change and their manipulation must be carefully controlled. Preliminary research and careful pre-experimental control had to be exercised to ensure that the treatments were operant during the experiment.

1. Determination of Treatment Levels

With regard to the various treatments, an operational problem exists. Since the subjects should be technically naive, one could not

expect them to be able to identify elements of distortion or noise within a passage; yet some measure must be taken to ensure that the level of the treatments is such that the variables can be perceived by the untrained listener, even if the untrained listener doesn't know exactly what he is expected to perceive. Another factor, mentioned in the discussion of distortion and noise, is that the treatments in the experiment must not be so severe that the subject material in the presentation becomes imperceptible or indistinguishable. Thus, two points had to be established for each variable. It was considered most feasible to establish the threshold of perception for each variable, when inserted in a presentation, and the threshold of obliteration of the subject matter by the treatment and consider a point between these two extremes as the suitable level for the purposes of the experiment.

Establishment of these levels was made via panels of untrained listeners. One panel of four individuals listened to a brief explanation of the three treatment variables, white noise, hum, and distortion, complete with audible examples of each. At the conclusion of this presentation, the panel members were told that they were about to hear 24 short segments of an audio presentation. They were told that each of the segments may or may not contain various amounts of the previously explained treatments. Each panel member was given an answer sheet to indicate which treatment, if any, he perceived in each segment. The segments had the various treatments inserted in ascending increments, with the particular treatment in each randomly placed and some segments left untreated. The lowest level at which 100 per cent of the panel correctly indicated each of the treatments was considered the threshold of

perception. The fact that either no treatment or one of three possible treatments might have been present, plus the fact that unanimity of the panel was required, guarded against guesses and misperceptions on the part of the panel.

The very nature of distortion caused some minor control problems. Whereas the noise element could be measured as a ratio of noise and program levels, distortion is a part of the program audio rather than an added element. Since the desired distortion was to be the result of over-driving an amplifier in the audio chain, the following method was used. The level at which the slightest distortion could be perceived by a trained audio control engineer was noted for a particular amplifier. The first example was recorded at slightly below the level (i.e., the highest possible level before audible distortion was present). In subsequent examples, the input level to the amplifier was increased by 2.5 db increments. On the particular amplifier used, it was found that an input of -30 db was still audibly undistorted while an input of -17.5 db was "very" distorted. These levels and the four 2.5 db increments between (-27.5, -25, -22.5, -20) were the six examples of distortion used for the threshold experiment.

Examples for white noise were given from 50 db below standard operating level (0 db) to 25 db below standard operating level. At -50 db the white noise was indistinguishable from normal system noise and at -25 db the presence of the white noise was blatantly evident. Again six examples were used (-50, -45, -40, -35, -30, -25) for the threshold determination. The program audio was recorded at standard operating level.

Hum was found not to compete with the program audio as much as white noise. Hum levels of -20 db were barely audible to trained audio engineers. Again six treatments at 5 db increments were used, the levels being higher than those for white noise. Examples included -20 db (barely audible), -15, -10, -5, 0 and +5 db. The +5 example was quite noticeably hum-laden.

The order of presentation for the 24 examples was randomly determined. The only restrictions were that no two consecutive examples would be of the same treatment and that the examples of each treatment would be presented in increasing order. Six of the examples were left untreated.

The members of the panel were selected from available, normal-hearing subjects who had no knowledge of the purposes of the experiment. They listened to a brief description of each treatment, complete with audible example, and were then given answer sheets and told to indicate which treatment, if any, they heard in each of the 24 segments.

The subjects were surprisingly able to identify even relatively low levels of the treatments. The thresholds were established as follows: hum, -15 db; white noise, -40 db (relative to a 0 db standard operating level). Distortion proved to be perceptible by the untrained panel when the amplifier was driven at -27.5, 2.5 db greater than the distortion perceivable by a trained listener.

The next process was that of determining the threshold of obliteration, the level at which the treatment began to mask out the program audio. Again a panel was used, this time composed of three available untrained listeners. The subjects were asked to write down the sentences heard in the samples. The treatments started out at a fairly high level

and increased to a level where persons knowing the sentences could not identify them. Six examples, in 5 db increments, of each treatment were used. No attempt to disguise the particular treatment was made but the sample sentences were not known to the subjects. White noise and distortion easily obliterated the program audio when introduced at fairly high levels. White noise at 0 db was established by the panel as the threshold of obliteration whereas driving the amplifier at -15 db (7.5 db greater than the threshold of perception) was found to be the point at which the program became distorted to the point of unintelligibility.

Hum provided a problem. Since the hum is a 60 Hz tone and since male speech is around 150 Hz,⁵ even excessive amounts of the hum did not mask out the program. High amounts of hum were very audible and considered by the panel as objectionable and distracting, yet not even when the level of the hum was 15 db greater than the program did obliteration take place. It was decided that no reasonable threshold of obliteration could be established for 60 Hz hum.

By using the point midway between the threshold of obliteration and the threshold of perception, the following levels were established as the treatment levels: White noise, -20 db; distortion, -20 db, relative to the particular amplifier used; and hum, 0 db. Because no threshold of obliteration could be established for hum, 0 db was chosen as the treatment level since at that level there are equal amounts of hum and program audio. The results of the threshold tests are included in complete form in Appendix C.

2. Insertion of the Treatments

The multi-track configuration proved exceptionally useful when preparing the treatment tapes. On the sections of tape on which the treatment messages had been recorded, white noise and hum were recorded at the appropriate levels on parallel tracks. This allowed the experimenter to make "mixes" of the various treatments merely by assigning the appropriate tracks to the mix-down machine.⁶ Four versions of the experimental tape were made. One was a "clean" copy for the control group, one had white noise, another hum, and still another, distortion. This method provided four presentations which were exactly the same except for the treatments. Treatments were inserted only during the treatment messages. The introductory instructions and questions were kept free of quality deficiencies.

Using the above methods, the experimenter was able to ensure that (a) the independent variables were operant, being well above the threshold of perception, (b) that the treatments were not overly severe, being well below the threshold of obliteration, and (c) that all other aspects of the experimental presentation remained constant.

E. Measurement of Dependent Variables

One of the extremely important controls imposed on the experimental variables is the measurement of the dependent variables. Previous research often dealt with both comprehension and source credibility as dependent variables, thus providing several possible measuring instruments from which to choose. An examination of the various methods and the rationale behind these methods was necessary to determine the most

feasible methods of measuring the dependent variables in the present experiment.

1. Comprehension

Previous research involving comprehension as a dependent variable has brought forth two suitable methods of measuring comprehension:

- a. Multiple choice or true/false type questions.
- b. The "cloze" procedure.

The first is by far the most familiar and widely used and thus requires little explanation. One factor, however, should be noted. The construction of a multiple choice test requires some subjective judgment on the part of the test writer. Because of this, reliability of the test would tend to be a function of the test writer's ability.

The second alternative is called the "cloze" procedure, originally developed by Wilson L. Taylor as a tool for measuring readability.⁷ Dickens and Williams reported that the cloze procedure was a valid indicator of comprehension of aural messages. This procedure consists of preparing a copy of the text with every fifth word removed.⁸ The subject, after hearing the presentation, is given the edited text and instructed to fill in as many of the omissions as he can. This method has the advantage of removing the bias of the test writer from the instrument. The only problem is that the passage must be of sufficient length to permit enough blanks to provide for chance distribution of difficulty.⁹

The STEP listening tests¹⁰ provide passages and questions which are already validated. This factor, combined with the scoring ease and the subjects' familiarity with multiple choice testing, caused the author

to choose multiple choice questioning, from the STEP tests, as the measure of comprehension in the present study. The first selection had nine questions included and the second selection had eight questions. This provides a possible range of scores from 0 to 17 correct as the measure of comprehension.

2. Source Credibility

In their extensive summary of source credibility research, Anderson and Clevenger listed several methods for measuring source credibility including rankings, sociograms, Thurstone-type scale, and semantic differential scales.¹¹ Subsequent research has shown the semantic differential-type scales to be the most widely used.

There has been some disagreement as to what dimensions of credibility should be utilized. Aristotle named intelligence, character, and good will as the dimensions of ethos.¹² In 1953, Hovland, Janis, and Kelley identified essentially the same factors under the nomens expertness, trustworthiness, and intention toward receiver.¹³

Perhaps the most-used scales for source credibility measurement were developed by Berlo and Lemert and presented to the Speech Association of America at the 1961 convention. Their study used the dimensions of competence, trustworthiness, and dynamism.¹⁴ The first two factors correspond fairly well with Aristotle's intelligence and character and Hovland, Janis, and Kelley's expertness and trustworthiness. The dynamism factor, however, was something different from previous measures. McCroskey did some experimentation, concluding that dynamism was not a valid indicator of source credibility.¹⁵ Later, in 1969, Berlo, Lemert,

and Mertz experimented with a great many scales and dimensions and finally came to the conclusion that three dimensions, safety, qualification and dynamism, would be the most representative for evaluating source credibility for the receiver's point of view.¹⁶ The following scales are suggested:

Safety: safe--unsafe; just--unjust; kind--cruel; friendly--unfriendly; honest--dishonest.

Qualification: trained--untrained; experienced--inexperienced; skilled--unskilled; qualified--unqualified; informed--uninformed.

Dynamism: aggressive--meek; emphatic--hesitant; bold--timid; active--passive; energetic--tired.¹⁷

This, of course, differs from McCroskey, who feels that dynamism is probably a factor of competence.¹⁸ Since there is no unanimity among the scholars, the present study includes the dynamism dimension, since most previous studies have done so, and uses the above-mentioned Berlo, Lemert and Mertz scales since they are the most recent three-dimension measures reported.

The scales were scored using one as the most negative response and seven as the most positive response. Using this method, the possible summated score for each dimension ranged from 5 for the lowest to 35 for the highest. These summated scores were used as the operational measures for the three dimensions of source credibility.

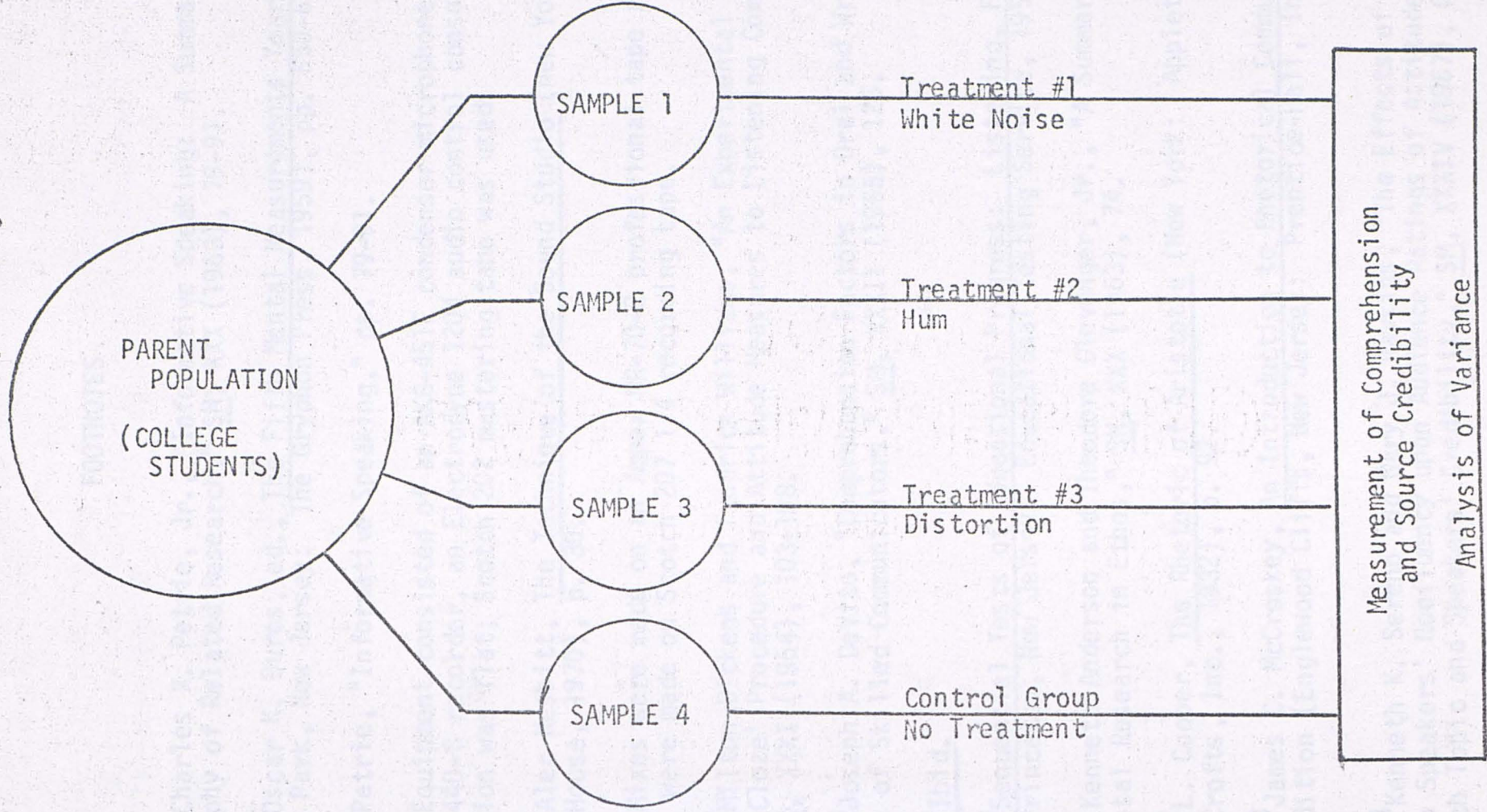
F. Data Analysis

Without a valid analysis of data the raw results of an experiment

are useless. In the present experiment the focus is on differences. The research question involves determining whether or not any significant differences are present between the control group (no treatment) and the treatment groups (hum, white noise, or distortion) with regard to comprehension or source credibility. Since both dependent variables are measured in terms of numerical scores, an analysis of variance provides an effective means of data control. As indicated in Figure 2, the three treatment groups and the control group are drawn from the same population of speech and communications students and the equality of these groups with respect to listening ability is controlled by the pre-test data. It is necessary only to compare the comprehension, safety, qualification, and dynamism scores of the four groups via F and t tests to determine if differences exist and, if there are differences, where they exist.

All of the various methods of control, whether of extraneous variables, experimental variables, or data, work together to reduce the possibility of experimental error and to increase the validity of the results and conclusions of the present study.

Figure 2--Design Paradigm



FOOTNOTES

¹Charles R. Petrie, Jr., "Informative Speaking: A Summary and Bibliography of Related Research," SM, XXX (1963), 79-91.

²Oscar K. Buros, ed., The Fifth Mental Measurements Yearbook (Highland Park, New Jersey: The Gryphon Press, 1959), pp. 650-652.

³Petrie, "Informative Speaking," pp. 79-91.

⁴Equipment consisted of an AKG-451E condenser microphone, an Ampex AG-440-8 recorder, an Electrodyne 1204 audio control console. Equalization was flat; Scotch 202 mastering tape was used.

⁵Alec Nesbitt, The Technique of the Sound Studio (New York: Hastings House, 1970), p. 30.

⁶Mixes were made on an Ampex MR-70-2 professional tape recorder. All mixes were made on Scotch 207 1/4 recording tape.

⁷Milton Dickens and Fredrick Williams, "An Experimental Application of 'Cloze' Procedure and Attitude Measures to Listening Comprehension," SM, XXXI (1964), 103-108.

⁸Joseph A. DeVito, "Comprehension Factors in Oral and Written Discourse of Skilled Communicators," SM, XXXII (1965), 125.

⁹Ibid.

¹⁰Sequential Tests of Educational Progress: Listening, Form 1A and 1B (Princeton, New Jersey: Educational Testing Service, 1957).

¹¹Kenneth Anderson and Theodore Clevenger, Jr., "A Summary of Experimental Research in Ethos," SM, XXX (1963), 74.

¹²L. Cooper, The Rhetoric of Aristotle (New York: Appleton-Century-Crofts, Inc., 1932), p. 92.

¹³James C. McCroskey, An Introduction to Rhetorical Communication, Second Edition (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1972) p. 65.

¹⁴Kenneth K. Sereno and Gary J. Hawkins, "The Effects of Variations in Speakers' Nonfluency upon Audience Ratings of Attitude Toward the Speech Topic and Speakers' Credibility," SM, XXXIV (1967), 60.

¹⁵J. C. McCroskey, "Scales for the Measurement of Ethos," SM, XXXIII (1966), 65-72.

¹⁶David K. Berlo, James B. Lemert, and Robert J. Mertz, "Dimensions for Evaluating the Acceptability of Message Sources," POQ, XXXIII (Winter, 1969-70), 563-576.

¹⁷Ibid., p. 574.

¹⁸McCroskey, An Introduction to Rhetorical Communication, pp. 64-67.

CHAPTER III

PROCEDURE

A. Initial Procedure

Although a preliminary pilot experiment was planned to identify as many procedural problems as possible, every effort was made to ensure an initially smooth procedure so that only minor changes, if any, would be necessary after the pilot experiment. The following procedure was developed.

Upon arriving at the language lab, each subject checked in with an assistant who distributed the test booklets. The initial instructions were printed on the covers of the test booklets and read as follows:

INSTRUCTIONS

1. Please be seated in booth number _____.
2. Turn the knob in front of you labeled "mic" counter-clockwise until it clicks off. (It may already be in the "off" position.)
3. Put on the headphones.
4. The experiment will begin soon. Some music will be played prior to the experiment; take this time to fill in the information at the bottom of this page. Also, adjust the volume control to a comfortable listening level. It is very important that you do not adjust your headphones during the experiment.

5. The announcer (on tape) will give you instructions for the experiment; please listen carefully.

Blanks were provided for the subject's name and Social Security number. The question, "To your knowledge do you have any extreme hearing loss?" was included with blanks for a yes or no response.

Approximately three minutes of background-type music was played prior to the experimental tape. This afforded the subjects a chance to become comfortable with their headphones and allow a little "sleeve time" for tardy subjects. At the conclusion of the recorded music, the recorded announcer stated that the experiment was about to begin. The announcer then explained that a speaker, Robert Hanna (fictitious name) would read a selection, after which some questions would be asked. He told the subjects how to mark their responses, explained that each question would be read only once, and admonished the subjects to "listen carefully." An exact transcript is given in Appendix B. Then the first treatment message, read by a different speaker, came on. At the conclusion of the first treatment, the announcer read the nine comprehension questions for the first reading, allowing time for responses after each question. After the nine questions, the same "Robert Hanna" who read the first selection, read the second selection. At the conclusion the announcer read the eight comprehension questions for the second reading, again allowing time for responses after each question. The announcer next instructed the subjects to read the next page along with him. He then read the instructions for filling out the semantic differential-type source credibility scales. The instructions were based on "typical instructions" given by Osgood, Suci and Tannenbaum in The Measurement of

Meaning.¹ The announcer also reminded the subjects that they were rating Robert Hanna, the speaker who had read the two selections to them. The announcer then instructed the subjects to fill out the semantic differential-type scales on the following page. At the bottom of the page containing the fifteen source credibility scales, the instructions, "Please turn to the following page when you complete the scales," were printed. Upon turning the page, the subjects found the following instructions:

This completes the experiment. Please check to make sure that all your answers are marked clearly and that your name and Social Security number are on the front cover. You may leave; please be sure to give your test booklet to the attendant.

Thank you very much for your time.

The subjects were to be checked off by the attendant upon handing in the completed booklet, thanked again for their cooperation, and dismissed. All of the recorded instructions and the preliminary music were incorporated into the experimental tape and would thus be exactly the same for all treatments at all times. This sequence of events was the initially conceived procedure.

B. The Pilot Experiment

A number of questions as to the soundness of the above procedure had to be answered prior to the final experiment. There also needed to be a check to ensure that no unforeseen operational problems would crop up.

The pilot study was designed to answer the following questions as well as to show up any unforeseen problems:

1. Would the subjects have trouble finding the language lab?
2. Would having an assistant check in the students be an effective, nonconfusing method?
3. Would one assistant be unable to handle the entire experiment, if necessary?
4. Would the subjects have any problems understanding the instructions on the cover of the test booklet?
5. Would the subjects tend to answer "Yes" on the hearing loss question as a joke?
6. Would the subjects attempt to adjust their headphones when the treated portion of the tape came on?
7. Would the subjects have any problems filling out the comprehension part of the test?
8. Would the subjects have any problems filling out the source credibility portion of the test?
9. Would the subjects tend to skim over the source credibility scales in an effort to leave the experiment early?

For the pilot experiment, eleven subjects were instructed to report to the language lab at a specific time. Of the above-mentioned potential problems, none appeared to be present. All questions could be answered "No." Two slight unforeseen problems were encountered, however.

1. Prior to the experiment, during the music, some of the subjects were talking to one another and thus contaminated the experimental environment.

2. A subject with a faulty test booklet (missing page) did not report his problem but assumed that it was part of the experiment.

The first problem was solved by adding a "Please do not talk while in the language lab" instruction on the covers of the test booklets. The second problem was solved by carefully checking all test materials and not depending on the subjects to report such problems.

The data from the pilot group was not analyzed since these subjects had not taken the pre-test. The comprehension tests were scored to check for possible ceiling or bottoming effects. Neither was evident. Basically, the initial procedure operated very smoothly. With the slight adjustments mentioned above, the initial procedure was adopted verbatim for the final experiment.

C. Selection of Subjects

Of the 173 subjects who took the STEP listening pre-test, 117 completed the final experiment. Due to various procedural problems at Florida Technological University, including the fact that the subjects were not required to participate in the experiment, it was impossible to determine prior to the final experiment exactly which of the 173 potential subjects would be available for the final experiment. For this reason it was impossible to ensure that the groups would be equal with respect to listening ability, as measured by the pre-test. It was decided that the subjects should be placed into the various treatments at random. Also decided prior to the experiment was that if the groups did not come out relatively equal with regard to listening comprehension, the extreme scores would be discarded.

Subjects were asked to sign up for an experimental time, choosing from over 20 time slots, and given a reminder slip with the time and room number indicated. Despite these precautions, getting the subjects to the experiment provided some problems. The 117 who did appear came in groups ranging from one to 25 at a time, most of the experimental times yielding from three to six subjects. All together, the experiment was run 21 times. Many of the subjects had to be rescheduled because they either forgot their appointments completely or arrived after the experiment was already in progress. Despite these problems, 117 normal-hearing subjects completed the experiment.

D. Final Procedure

The procedure for the final experiment was nearly identical to the initial, pilot experiment procedure. The experimenter prepared a roll for each experiment time and checked off the subjects as they entered the language lab. The test booklets were essentially the same as the pilot experiment booklets except that the no-talking instruction was added to the cover of the test booklet. The tapes were started promptly at ten minutes after each hour. Tardy subjects who arrived during the introductory music were allowed to participate. Those subjects who did not arrive until after the narration had started were rescheduled. The tapes were assigned to the cubicles in a way that prevented the subjects from dialing in any of the other language lab tapes. As in the pilot experiment, the experimental procedure operated smoothly and no major problems were encountered. The tapes, which had been made on high quality recording tape² and handled carefully, showed no signs

of deterioration at the conclusion of the experiment.³

E. Preliminary Analysis of Data

At the conclusion of the experiment, the tests were scored by hand, using the template method. The primary area of interest was that of the listening ability pre-test scores. It was hoped that the random placement of subjects into the four experimental groups would yield groups of relatively equal mean listening ability. The pre-test scores ranged from 16 to 32 correct out of a possible 36 questions. Unfortunately, several of the extremely high scores fell into the control group while several of the extremely low scores fell into the hum and white noise groups. Upon preliminary F test analysis, significant differences were found between the groups with regard to listening ability, as measured by the listening pre-test. These results are shown in Table 1.

TABLE 1

INITIAL LISTENING PRE-TEST RESULTS

Group	N	Mean
Control	30	26.03
White noise	31	24.23
Hum	25	23.12
Distortion	28	25.64

F = 3.85 (significant at .05)

Because of this bias, it was necessary to discard the extreme scores. It was found that removal of the upper and lower ten per cent of the data diminished the differences to negligibility as shown in Table 2. Thus, all scores of 19 and below and all scores of 30 and above were discarded. This was an unfortunate loss of data but it provided the only valid method of equalizing the experimental groups.

TABLE 2
LISTENING PRE-TEST RESULTS AFTER REMOVAL
OF EXTREME SCORES

Group	N (after discarding extremes)	Mean
Control	26	25.35
White noise	26	25.12
Hum	19	24.63
Distortion	20	25.05

Analysis of variance yielded highly nonsignificant results ($F = 0.3$). The total number of subjects used in the final analysis was 91. With this equalization of the groups having been accomplished, the threat of contamination due to listener variables was minimized. It is interesting to note that while many experimenters rely on randomization alone as the control of listener variables, in samples of this size such a procedure may not be valid. If, for instance, there had been no pre-test measure in the present study, a bias favoring the control group

would have existed, increasing the probability of finding differences which were not actually present. Although it is never desirable to discard data, it is certainly more desirable to be ensured of equality of the experimental groups even if the equality is achieved at the expense of some of the data. Having accomplished this equalization, an analysis of variance for the comprehension, safety, qualification and dynamism scores could be undertaken.

The experimental tapes are stored at Florida Technological University, Department of Communications.

FOOTNOTES

¹Charles E. Osgood, George J. Suci, and Percy H. Tannenbaum, The Measurement of Meaning (Urbana, Illinois: The University of Illinois Press, 1957), pp. 82-84.

²Two copies of the experimental tape were made on Scotch 207 mastering tape.

³The experimental tapes are stored at Florida Technological University, Department of Communications.

Table 3

COMPREHENSION SCORES

Group	T	S	n
Control	11.5023	4.3516	25
Hum	13.2631	4.0943	19
White Noise	12.4519	3.8920	25
Distortion	13.2160	5.9062	20

$F = 0.53$

$N_1 = 91$

B. Source Credibility Results

The results of analysis of variance for the three dimensions of

CHAPTER IV

RESULTS AND DISCUSSION

A. Comprehension Results

The results of the analysis of variance for the comprehension test are shown in Table 3. An F of 0.52 is, of course, nonsignificant. The differences in the means are not even enough to report any trends, strong support, or tendencies other than equality between the control and treatment group scores. At face value it would seem that the various elements of poor quality had no effect on the comprehension of the subject matter.

Table 3

COMPREHENSION SCORES

Group	\bar{x}	σ	n
Control	12.6923	4.3816	26
Hum	13.2631	4.0943	19
White Noise	12.4615	3.6989	26
Distortion	12.8000	6.9052	20
F = 0.52		$N_t = 91$	

B. Source Credibility Results

The results of analysis of variance for the three dimensions of

source credibility are given in Table 4. Again no significant differences were found between any of the experimental groups. Again it would appear that hum, white noise and distortion have no effect on the source credibility of the presentation.

Table 4
SOURCE CREDIBILITY SCORES

Group	Safety		Qualification		Dynamism	
	\bar{x}	σ	\bar{x}	σ	\bar{x}	σ
Control	23.8846	14.2665	29.8076	14.0044	25.5769	10.1744
Hum	25.4736	18.5989	30.6842	10.0061	25.2631	11.5395
White Noise	24.9730	16.7158	28.5000	18.5000	24.7307	21.5663
Distortion	24.2500	16.8289	28.9500	16.2605	25.4000	6.9894
	F = 0.07		F = 1.35		F = 0.26	

C. Possibility of Error

When approaching an experimental situation where no significant differences, or even substantial trends, are apparent in the data, one must consider two possibilities: the first is that there actually are no differences; the second is that there is an experimental error. Unfortunately, when dealing with such nonsignificant differences one cannot statistically prove the former possibility but can make inferences only by eliminating, or at least reducing, the possibility of the latter.

The methodology chapter discusses in some length the controls

used to prevent finding differences which in actuality are not there. The same groups of variables should be considered when evaluating the possibility of finding no differences when differences actually exist.

1. Manipulation of the Independent Variables

The first and perhaps most obvious possibility is that the independent variables were not operant. If the subjects failed to perceive any of the quality deficiencies, there would, of course, be no significant differences in the performance of the experimental groups.

The problem in the present experiment is that the subjects may not necessarily have been aware that a treatment was present yet they may have unknowingly perceived the treatment. For this reason it is somewhat difficult to validate the operation of the independent variables. One would no more get accurate information by asking, "Did you hear any of the following: (a) white noise, (b) hum, (c) distortion, or (d) none of the above?" than one would by asking a group of subjects if they saw a red Ford last Tuesday. To begin with, some of the subjects wouldn't know a Ford from a Chevrolet. Secondly, the sighting of a red Ford is hardly unusual enough to cause the subject to make a conscious note of the incident. Similarly, the average listener (a) does not know hum from white noise from distortion, and (b) such quality deficiencies are so common in today's audio-visual world that the average person attaches little if any importance to hearing such elements in a tape.

The question at hand is not whether the subject knew what the treatment was called or whether the subject could remember hearing it; the question is, when he hears these elements, do they have an effect

on his comprehension or perception of source credibility?

While John Doe is driving, he waits for an oncoming red Ford to pass before making a left turn. Five minutes later, Mr. Doe does not really remember the red Ford, he may never have been aware that the vehicle in question was a red Ford, yet that red Ford influenced John Doe's behavior by causing him to wait before turning.

The present experiment also studies elements which may be unknowingly perceived. Although one cannot prove that the subjects perceived the treatments, one can reduce the probability that they failed to perceive the treatments. In preliminary research the thresholds of perception for each treatment were established using normal-hearing untrained subjects. This level was then increased halfway to the point at which nothing but the treatment was perceivable. With the resulting easily perceivable level and the removal of as many distracting elements in the environment as possible, the probability of the subjects not perceiving the treatments was minimal.

2. Measurement of the Dependent Variables

Another possible cause of failing to uncover differences is the insensitivity of the dependent measuring instruments. The difference in thickness between the hair of a human male and that of a female has, in all probability, existed since the beginning of mankind, yet the ability to perceive this difference has come about relatively recently with the advent of sensitive measuring instruments. In the social sciences inadequate measurements may also be the cause for nonsignificant findings. Again, the absolute validity of the instrument is very difficult, if not

impossible, to prove since such a proof would require a more sensitive instrument which, of course, if available would have been used in the first place. Once again, one can only reduce the probability of invalidity.

a. Comprehension.--In the present study two dependent measures were used. The first was the multiple choice comprehension questions. Using pre-existing questions is the primary defense for this measure. The fact that the Educational Testing Service, whose testing devices have been shown to be effective, developed the questions specifically for the given selection and specifically to measure listening comprehension tends to subjectively increase the validity of the test. As pointed out in the methodology chapter, the multiple choice type of questioning is the most popular measure of comprehension and has been used successfully to show comprehension differences in other experiments.¹ Also, as previously mentioned, no ceiling or bottoming effects were apparent.

The absolute validity of the comprehension measures cannot be proven but the method of testing and the particular questions (from Educational Testing Service) used have been validated by previous research. Although perhaps not ultimately sensitive, the measuring instrument used would seem to be the best available means of assessing comprehension.

b. Source Credibility.--The second dependent measure was the semantic-differential-type source credibility scale. This type of measurement is, of course, plagued by the inherent weaknesses of paper and pencil

measures of attitude.² Nonetheless, this instrument has been successfully used in other experiments and the particular dimensions and scales used were the most complete and current of those available. Anderson and Clevenger, in their 1963 summary, and subsequent writers cited the semantic-differential-type scales as one of the more valid measures of ethos.³ Many experimenters, such as Seiler,⁴ Addington,⁵ McCroskey,⁶ and others used the semantic differential and achieved significant results.

Another factor is that the present study asked the subjects to rate the speaker, not the presentation. While perhaps the quality deficiencies may have affected the subjects' attitude regarding the credibility of the presentation, as opposed to the speaker, no attempt to measure such changes was made. Such an attempt might be an interesting factor for future research.

The validity of the measuring instrument in this case cannot be proven, but one can conclude that any differences in the subjects' perception of the speaker, in terms of source credibility, were significantly less than differences caused by other variables such as nonfluency.

3. Environmental Variables

In any experiment there is the possibility that some outside variable may be operant to such an extent that the variables under consideration are masked out. An experiment on the effects of gestures in public speaking, for example, could well be totally invalidated if an outside variable, such as complete absence of light, were operant. The experimental environment in the present experiment was carefully controlled so that the subjects' perception was limited, as much as possible,

to the presentation and the treatments only. The use of headphones, for example, prevented interference from acoustic noise. The use of the cubicles minimized visual distractions. This type of methodology isolates the independent variables but ignores any possible interaction between the independent variables and the environment. Perhaps, for instance, distortion would significantly decrease listening comprehension when combined with visual distractions or outside acoustic noise. The present study made no attempt to examine such interactions but one must consider the possibility that such a relationship might exist. Again, the answers to these problems are left to further research. The present study can only claim that when isolating the variables from environmental distractions there seems to be no effect on comprehension and source credibility.

4. Message and Speaker Variables

In the present study, message and speaker variables are held constant across all treatments by using the same message and the same speaker. The potential problem is whether or not the constants used are generalizable to the real world. For instance, might there be significant differences if the experiment were run using a speaker of poor or marginal ability and experience? Would perhaps a message of poor or mediocre composition cause significant differences among the treatments? The data from the present study can shed no light on these questions. The validity of the speaker and message used can be established though. In most situations a message used in an informative presentation would be well composed like the ones used in the experiment. Similarly, most presentations would use a trained speaker as in the experiment. Thus,

although the possibility of differences occurring under various message and speaker conditions is present, the present study has provided constants of message and speaker variables which are generalizable to a great portion of real life presentations.

5. Listener Variables

The same type of potential problem as encountered in message and speaker variables could be operant in listener variables. The listening ability was controlled so that there was equality among the experimental groups but only one type of listener was examined. Since the extreme scores were discarded, the only subjects examined were those of average listening ability for college students. Of course, any college student is somewhat of an expert in listening because by the very nature of his position he has spent at least twelve years at successfully comprehending verbal messages. Would the experimental results have been different had sixth graders or high school drop-outs or some other less able group of listeners been used as subjects? Such a question could only be answered by additional research. The validity of using the college students as subjects is not as narrow as it might appear, however. Whereas introductory speech students are not a totally typical population, they are probably typical of college students, and college students are the intended receivers of a great deal of the recorded informative presentations produced. The present study cannot make inferences to other consumers of informative presentations but does provide some insight into the behavior of one major group of receivers of audio presentations, college students.

D. Significance of the Study

The present experiment is only an exploratory study. It does, however, provide some interesting results. Despite the possible problems previously discussed, there is strong support for the hypothesis that, under the given conditions of trained speakers, well-written messages and college listeners, the quality deficiencies examined did not, by themselves, have an effect on either comprehension of the message or source credibility. While this conclusion may not be startling to the academician, it certainly represents a hypothesis contrary to all professional audio tradition. The ill effects of poor audio quality, if any, would appear to be somewhere other than in the areas of comprehension or source credibility. Although the present study is by no means definitive, it poses an empirical threat to the subjective traditions of audio production. Whether or not this threat will withstand the tests of future exploration remains to be seen, but if subsequent research follows the pattern of the present study, audio producers may be forced to re-evaluate the entire concept of quality. Perhaps future research will show that poor quality has an effect on other functions of presentations. If this is the case, the audio man will at least have some empirical, functional parameters within which to base his decisions concerning quality. If future research cannot find any relationship between quality and functionality, the producers of audio presentations would want to set up totally different criteria for quality standards.

In either case, the function of the present study is constant. The results of the present experiment have failed, despite utilization of the best available means, to bear out the subjective traditional

hypotheses and by this failure to affirm, point the empirical finger at the validity of the traditional standards.

E. Implications for Future Research

Of course, before any indictments are leveled against tradition, additional information is necessary. As mentioned above, the results of the present study cannot be generalized to all instances. Several avenues might be explored.

Firstly, different quality deficiencies might be explored with respect to the same dependent variables. White noise, hum and distortion were selected as common audio problems but this selection by no means excludes the possibility of other factors being operant. One might also wish to explore different presentations of the independent variables. The present study examined only constant treatments. Perhaps intermittent presentations of the independent variables would be more distracting and subsequently more damaging to the comprehensibility of the message.

Other dependent factors might also be considered. A study of long-term retention, for example, might yield different results. Other important communicative factors might be attention or attitude change. The possibilities are numerous but should be restricted to functional variables. If the purpose of a presentation is to inform, then attention might well be one of the functional elements. If the purpose of the presentation is to lull the audience to sleep, perhaps attention is not so functional. Subjective analysis has failed to define quality deficiencies in terms of function and this failure must not be proliferated by empirical research.

Other possibilities for future research were mentioned earlier. While a great many recorded presentations deal with good messages narrated by trained speakers for consumption by college students, there are many cases where one or more of these factors may differ. For this reason, research might be undertaken using different types of messages, speakers, and listeners.

Also previously mentioned was the possibility of interaction effects. Environmental conditions may, when found in conjunction with the quality deficiencies, cause more marked effects. Interaction may also be present with message, speaker, or listener variables. The gamut of possibilities is virtually limitless and unexplored. While it may be unfeasible to examine every possibility, a certain amount of additional research is necessary before any educated generalizations can be made.

F. Summary

The present study set out to examine, empirically, the effects of certain types of poor audio quality on comprehension and source credibility in tape-recorded presentations. Tradition in the audio industry would lead one to hypothesize that a poor-quality production would produce significantly less comprehension than a high-quality production. Although this notion is widely accepted on a subjective basis, an examination of previous research yielded no empirical support for such a conclusion.

The present experiment sought to empirically examine the traditional concepts. An informative presentation was produced in four versions, one containing white noise, another containing hum, another,

distortion, and a control version which had no quality deficiency. Preliminary research was undertaken to establish levels for the presentation of these treatments that were easily perceivable by the average listener yet not severe enough to mask out the program material.

Four experimental groups were selected at random from available students in introductory communications courses at Florida Technological University. Each group listened to one version of the presentation, after which they were asked to respond to several comprehension questions and a set of source credibility scales. The groups were pre-tested for listening ability and the groups were equalized with respect to this variable. The message, delivery, and speaker were identical in all versions. Environmental variables were controlled by placing each subject into a headphone-equipped cubicle, thus reducing visual and acoustic distractions. Every effort was made to eliminate any outside variables.

The message, delivery, and speaker were chosen to be representative of a typical informative production. The message was clear and the speaker was experienced. The study examined the effect of quality deficiencies in an otherwise well-produced presentation. The most reliable of available means to measure comprehension and source credibility were used. The former was measured via multiple choice questions made up and pre-tested by Educational Testing Service,⁷ and the latter was assessed via semantic differential-type scales on the three dimensions of source credibility proposed by Berlo, Lemert, and Mertz.⁸

Analysis of the data yielded no significant differences between the control and treatment groups. Such data may be the result of one of two causes. The first is that there are actually no differences, and

the second is that there was some sort of experimental error. Although the absence of experimental error cannot be proved, the probability that a significant error was operant was analyzed and found to be relatively small. The data from the present study, though by no means conclusive, tends to support the hypothesis that quality deficiencies do not have a significant effect on comprehension or source credibility, at least in productions, good in all other aspects, presented to college student receivers.

Future research is, of course, necessary to validate such a hypothesis. Perhaps different independent and dependent variables could be examined. Also, different types of speakers, messages, deliveries, and listeners could be examined. If research of this type confirms the no-effect hypothesis, the quality standards of informative audio presentation will have to be thoroughly reviewed. If future research reveals areas where quality deficiencies do have an effect, these critical areas can be identified and dealt with. In either case, a great deal of future research is necessary. The present study paves the way for this research and effectively begins to point an empirical finger at the subjective traditions of the audio production world.

FOOTNOTES

¹Charles R. Petrie, Jr., "Informative Speaking: A Summary and Bibliography of Related Research," SM, XXX (1963), 79-91.

²Gerald R. Miller, "A Crucial Problem in Attitude Research," QJS, LIII (1967), 235-240.

³Kenneth Anderson and Theodore Clevenger, Jr., "A Summary of Experimental Research in Ethos," SM, XXX (1963), 59-78.

⁴William J. Seiler, "The Effects of Visual Materials on Attitudes, Credibility, and Retention," SM, XXXVIII (1971), 331-334.

⁵David W. Addington, "The Effect of Vocal Variations on Ratings of Source Credibility," SM, XXXVIII (1971), 242-247.

⁶James C. McCroskey, "Scales for Measurement of Ethos," SM, XXXIII (1966), 65-72.

⁷Sequential Tests of Educational Progress: Listening, Form 1A and 1B, (Princeton, New Jersey: Educational Testing Service, 1957).

⁸David K. Berlo, James B. Lemert, and Robert J. Mertz, "Dimensions for Evaluating the Acceptability of Message Sources," POQ, XXXIII (Winter, 1969-1970), 563-576.

Appendix A

TRANSCRIPT OF STEP LISTENING PRE-TEST TAPE

0:00 Announcer You are about to take a test in listening. Let me go over the instructions briefly. I will read each selection to you and then I will read each question. Four possible answers are printed in your test booklet. Read them and then mark the correct space on your answer sheet for the one you select. Remember to listen carefully because I can read each selection and each question only once.

0:35 Announcer Here is the first selection. It is an announcement of a course in listening.

 A group of members of the New York Adult Education Council has asked us to announce a course on listening. This group is the Leadership Clinic group that has been meeting regularly over the past two years. Among them are people from social work, business, adult education, and organizations like the League of Women Voters and the Urban League.

Distilled out of the experience of the Clinic are these ideas: that the ability to listen is one of the prime leadership skills; that a great many people with leadership responsibility do not listen well; and that mature people who are poor listeners do not readily learn to listen, but that they can be taught.

Listening is broadly defined as an attitude toward other people and what they are attempting to express. It begins with attention, both the outward manifestation and the inward conviction. It includes constructive responses that help the other person express both his thoughts and his feelings. A good listener has trained his memory to retain what is expressed and to refrain from piecemeal value judgment. The good listener keeps himself in a position to assess the relationship between the facts, opinions, attitudes and feelings being expressed, and is therefore able to respond to the total expression of the other person. Listening is a discipline which improves face-to-face personal relations;

5:18 Announcer

it saves time in the process of communicating; and it gives the listener a better grasp of what other people have to tell him.

5:52 Announcer

The requirements for admission to this course are that the applicants be adults who will commit themselves for regular attendance at the six sessions; that at present they have leadership responsibility for a group; and that their primary motive in attending is that they want to learn to listen.

6:25 Announcer

2:25 Announcer

Question number 1:

What are the requirements for admission to the listening course described in this selection?

3:16 Announcer

Question number 2:

The speaker classified listening first as

3:40 Announcer

Question number 3:

The speaker suggests that the chief characteristic of a good listener is

4:30 Announcer

Question number 4:

Why was this course being organized?

- 5:18 Announcer
Question number 5:
All of the following points about listening were made by the speaker EXCEPT:
- 5:52 Announcer
Question number 6:
The purpose of this selection is to
- 6:25 Announcer
Here is the second selection. It is a short narrative.
That tireless investigator of other people's business, George Jones, took his "candid camera" and his concealed microphone out the other day to find out how many people knew what the word "retroactive" meant. He walked up to an elevator starter and declared belligerently: "Listen, I think you ought to know that the last elevator on the right side is retroactive."
"Gee," said the starter, "haven't heard any complaints from the elevator man."
"It's dangerous."
"Gee, we'll have to look into it. You think it's very dangerous?"
"It certainly is dangerous. You can get into all kinds of trouble with that."

Mr. Jones then wandered out, smiling his sadistic smile, and accosted a young lady at a soda fountain. "Boy," he exclaimed, "isn't this weather retroactive, though." She agreed heartily that it was.

"Most retroactive day we've had," said Jones.

"Yes," said the girl. "Terrible."

"You know what retroactive weather is, don't you?" asked Jones.

"Very hot without stopping," said the girl firmly.

The next victim was a gentleman window shopping. "Hey, buddy," said Jones grimly. "If I were you I wouldn't go into that store."

"Why not?"

"Those people in there, they're very retroactive . . . I mean if a store is retroactive, the least you can do is pass 'em by."

"Well," said the man uncertainly, "as long as you insist."

"I don't insist. It's just my advice. Would you--do you--ever go into stores that

10:47	Announcer	are retroactive?" selection. It is a talk
		"Well, I've taken chances before."
8:03	Announcer	<p>Question number 7: <i>name Society has called</i></p> <p>Which of the three people spoken to by <i>are</i> Mr. Jones came close to understanding the real meaning of "retroactive"?</p>
8:35	Announcer	<p>Question number 8: <i>is are brought into</i></p> <p>Which of these human characteristics was revealed by the people interviewed?</p>
9:05	Announcer	<p>Question number 9: <i>minerals, and so forth,</i></p> <p>Why does the window shopper hesitate to go into the store? <i>is, thrive,</i></p>
9:35	Announcer	<p>Question number 10: <i>to spend their lunch</i></p> <p>What does the soda-fountain girl think "retroactive" means? <i>ing to argue whether that may or may not be the result. Child-</i></p>
10:10	Announcer	<p>Question number 11: <i>raw the expected con-</i></p> <p>Which of the following is the best title for this talk? <i>the effect upon the child's emotional development of being encouraged to indulge in the slow torture of helpless creatures; and the suppression of his protective instincts.</i></p>

10:47

Announcer

Here is the third selection. It is a talk criticizing certain educational practices.

The National Humane Society has called my attention to certain projects that are under way in some elementary and high schools.

To teach children and youths proper nutrition, live animals are brought into classrooms--white rats, chickens, guinea pigs, rabbits--and the children are instructed to feed them on diets deficient in certain vitamins, minerals, and so forth, and see how they sicken and die, while others, fed properly, thrive.

It is hoped by such demonstrations the children will learn to spend their lunch money for milk instead of candy!

Now, I am not going to argue whether that may or may not be the result. Children do not always draw the expected conclusions from their learning. What does concern me is the effect upon the child's emotional development of being encouraged to indulge in the slow torture of helpless creatures, and the suppression of his protective instincts.

I am not a sentimentalist. I have never joined the antivivisectionists. Carefully controlled scientific experiments made upon animals have contributed immeasurably to the knowledge that has made it possible to wipe out many scourges of both humans and animals.

But what is being done in the classrooms is not scientific experimentation, and it adds nothing to knowledge. The teachers know in advance the results of the mistreatment, and so will many intelligent children. It is, therefore, systematic training in cruelty and indifference to suffering.

Very often a child's first real love is for an animal. Children are given pets in order to nurture affectionate and protective feelings. Many children are more sensitive to the suffering of animals than to that of humans. They become humane by stages.

Our children may be suffering from malnutrition, despite their high average caloric intake. But what society, and children as members of it, are suffering from

14:11 Announcer
 in far more serious degree is the extraordinary brutality, aggressiveness, and callousness of feeling that results in delinquency, crime, and psychopathic derangements.

14:34 Announcer
 Anything which encourages cruelty and indifference in the young is evil and profoundly antieducational. It is bringing up the child in the way he should not go. It is demonstrating to him that it is all right to mistreat nonhuman living creatures, if the mistreatment contributes to his own well-being. The logical deduction is that it's all right to mistreat humans, too, if it furthers one's own interest.

15:45 Announcer
 The consciousness it awakens is conscienceless.

16:02 Announcer
 It cannot be defended within any concept of goodness.

17:52 Announcer
 It should be stopped.

13:40 Announcer
 Question number 12:

In elementary and high school, the speaker wants projects such as he has described

14:11	Announcer	Question number 13: In these projects what to feed the animals is
14:34	Announcer	Question number 14: What point does the speaker mean to make when he objects that teachers know the results of these experiments ahead of time?
15:15	Announcer	Question number 15: The speaker expressly approves of
15:43	Announcer	Question number 16: Which of the following claims would best support the speaker's main point?
16:32	Announcer	Question number 17: The speaker develops his points mainly by
17:59	Announcer	Here is the fourth selection. It is a poem about an old lady. I went to the dances at Chandlerville, And played snap-out at Winchester. One time we changed partners, Driving home in the moonlight of middle June,

18:14 Announcer
And then I found Davis.

We were married and lived together for
seventy years,

18:48 Announcer
Enjoying, working, raising the twelve
children,

Eight of whom we lost

Ere I had reached the age of sixty.

19:15 Announcer
I spun, I wove, I kept the house, I nursed
the sick,

I made the garden, and for holiday

Rambled over the fields where sang the

19:41 Announcer
larks,

And by Spoon River gathering many a shell,

And many a flower and medicinal weed--

20:16 Announcer
Shouting to the wooded hills, singing to
the green valleys.

At ninety-six, I had lived enough,

And passed to a sweet repose.

20:40 Announcer
What is this I hear of sorrow and weariness,
Anger, discontent and drooping hopes?

21:08 Announcer
Degenerate sons and daughters,

Life is too strong for you--

It takes life to love Life.

18:14	Announcer	Question number 18: From the speaker's comments, we get the impression that she
18:48	Announcer	Question number 19: In this poem, the speaker summarizes her experiences
19:15	Announcer	Question number 20: We can infer that the speaker did not like
19:47	Announcer	Question number 21: The speaker lost eight of her children
20:16	Announcer	Question number 22: Why does the speaker talk of "degenerate sons and daughters"?
20:40	Announcer	Question number 23: Is the speaker in this poem dead or alive?
21:08	Announcer	Question number 24: The poem tells us that the speaker and her husband

- 21:33 Announcer Question number 25:
The speaker in this poem
- 22:07 Announcer Here is the fifth selection. It is a
single sentence taken from a speech about
optimism.
"To me optimism, when it is not merely
the thoughtless talk of such as harbour
nothing but words under their low foreheads,
appears not simply as absurd, but as a
really wicked way of thinking, as a bitter
mockery of the unspeakable suffering of
humanity."
- 22:33 Announcer Question number 26:
When the speaker says an attitude of
optimism is "absurd," he probably means it
is
- 22:58 Announcer Question number 27:
The speaker implies that verbal facility
may be
- 23:34 Announcer Question number 28:
Which one of the following statements could
one make on the basis of the speaker's
remark?

24:07 Announcer Question number 29:
Whom did the speaker exempt from his accusation?

24:35 Announcer Question number 30:
The speaker asserted that optimism is wicked because

25:07 Announcer Here is the sixth selection. It is a speech about success.

One day as I was standing by the blackboard, Bill came up and told me that he was going to write on the subject, "Making a Million Dollars." I said, "What would you do with a million when you had made it?" He said, "Oh, I'll know how to spend it all right once I get the million." Well now, I wonder.

I began my speech with Bill and his million dollars because it seems to me that he was then doing something which we are all very much inclined to do--that is, to take for granted the important thing while we concentrate on the thing that is not important.

Notice how we do this in connection with our plans for the future. If I asked girls something about their plans for the next ten, fifteen, twenty, twenty-five years, I would probably hear something about mink coats, and strings of pearls, and sometimes, all of these--a beautiful home, the usual charming children, and a husband who is devoted and intelligent. They're taking for granted that they will be wise and cultured and intelligent; that they will know how to be wise companions to their husbands; that they will have the sense to help him when he needs someone with whom he can talk over his problems; and that they will be wise counselors to their children. They just think somehow that these qualities will come when they are thinking about the Georgian house or the modern house or the Cape Cod cottage and about the man who will adore them. And yet, it is much harder to be a wise, understanding companion than it is to have a mink coat. If you don't believe it, count the mink coats you see, and the number of wise women--the women who are real

companions and friends to their husbands.

Now, in what I have been saying, the important has been something spiritual, and the unimportant has been something material. I grant that it is very easy, very natural, for us to concentrate on the material as against the spiritual. For one thing, because we can see the material. We can count our dollars and can count our interest. For another thing, and perhaps this is more important, we think of spiritual things as being within our reach at any time. I can change my mind; I can change my way of thinking; I can change my way of feeling any time I want to. Well now, from one point of view this is true; from another point of view it is not true. We think that we can decide to be intelligent, to be the type of person I have described. But it takes a long, long time to get these qualities, once we have decided we want them. It's like deciding that you will work no longer merely to get grades, but to learn something. Your whole college course will be changed once you make that initial decision, but when you make the decision

31:41	Announcer	you still don't know anything. You have to start to learn something. It takes us years, once we have decided to become intelligent, thoughtful, wise, to get there.
28:14	Announcer	Question number 31: As a result of his talk, the speaker hopes that his hearers will
31:53	Announcer	Question number 32: Which of the following conclusions fits the speech most exactly?
28:47	Announcer	Question number 33: What does the speaker assume about his audience?
29:30	Announcer	Question number 34: The speaker chose to begin his speech with
30:07	Announcer	Question number 35: The principal means the speaker uses to support his argument is
30:42	Announcer	Question number 36: The speaker develops his talk chiefly by
31:24	Announcer	

31:41 Announcer

This concludes the listening test. Be sure that you have printed your name and Social Security number on the answer sheet and that you have marked all your answers clearly.

0:00 Music

2:52 Announcer

Thank you for your time.

31:53

Selections and questions taken from STEP Listening Test Form 1B, Part One.

3:36 Announcer

The first selection is a lecture on an aspect of language. Your speaker will be Mr. Robert Hains.

3:46 Robert Hains

We tend to think of language as an accurate stable thing, which we can use as we might a hammer or a pencil. It has a function and it will always serve that function.

Appendix B

TRANSCRIPT OF EXPERIMENTAL TAPE PRESENTATION

0:00	Music	-----
2:52	Announcer	You are about to take part in an experiment designed to measure the effectiveness of tape recorded presentations. In a moment another speaker will read a short selection to you. Afterward, I will ask you some questions about the reading. He will then read another selection; again, I will ask you some questions about the reading. After that, I will ask you some questions about the speaker. If you have not already done so, adjust the volume control in front of you to a comfortable level. Please do not adjust this level once the readings start. This is very important.
3:34	Announcer	The first selection is a lecture on an aspect of language. Your speaker will be Mr. Robert Hanna.
3:46	"Robert Hanna"	We tend to think of language as an accurate, stable thing, which we can use as we might a screwdriver or a pencil. It has a function and it will always serve that function

well. Actually, even at a very low level, language can become slippery. We are not always sure what we will get when we order a Chef's Salad in a restaurant. When I ask for a Mexican Sundae in East Lansing, I get a "What's that" look; but I've discovered that if I ask for a Tin Roof, I get an object which is indistinguishable from a Mexican Sundae. A rose by any other name is still a rose; but one does have to know what a rose looks like. If I go to a nursery man to order a firebush, he probably should ask me some questions or at least take me into his grounds and point, saying, "Is that what you want?" "Or that?" If he doesn't, I'm apt to come home with an Acantha lalandi instead of a Folius alatus--hardly the same thing!

What I wish to do today is illustrate the semantic changes which occur in language--to make you more aware of the ambiguities which can arise when we use words. There is the story of the American girl visiting in England. She was engaged and so was the daughter of her hostess. The two girls began to exchange confidences. In

the course of their remarks, the American girl said, with respect to the English girl's fiance, "I suppose he must see you every day." The English girl was insulted. Where the American girl had wished to stress the idea that wild horses couldn't keep him away, the English girl got the suggestion that her fiance had to be dragged in by the collar to visit her.

When we talk about a semantic change in language, we are referring to a change which occurs in the meaning of words. Words have a meaning today; in Shakespeare's day they may have had another; and yet a third in Chaucer's. As a matter of fact, they may have different meanings today as they are used by different people. Take the word "constable." For a city-bred boy whose contact with those who maintain peace and order in society is in the form of policemen or cops, a constable is some vague offshoot of this body of law-enforcing people, related in some way to a sheriff. To some of you, brought up where the constable was the police force, this concept is highly inadequate. Actually any concept of a

constable as a policeman is inadequate. Certainly it would not have satisfied one Charles D'Albert, Constable of France in the fifteenth century. As Constable he was first officer of the Crown, commander-in-chief of the armies, supreme judge in the military courts and in the courts of chivalry. The constables of England and Scotland had similar ranks and duties. Obviously, at one time, a constable was a much more important man than he is now. Yet the man who originally bore the title would probably be puzzled by both of these meanings. He was the master of the horse, or, literally, the count of the stable. We can imagine that in the houses of some of the lesser, poorer nobility his role might have been that of a glorified stable boy. Neither our French nor our modern constable would relish being tagged with the original meaning of the word. Certainly, in this case, the stable door seems to have been securely locked against the return of the horses.

This one word, then, illustrates two of the semantic changes which can take place in the meaning of a word. It can undergo

elevation--take on better associations, become more honorific. Or it can suffer degradation--take on a bad meaning, get a malodorous association, indicate less of an exalted rank than it did.

A knowledge of the processes through which words change meanings will make us more alert. A word may mean what we think it means, or it may be used in a sense with which we are entirely unfamiliar.

9:50 Announcer
7:46 Announcer

Here are the questions for the first reading. Open your test booklet to page one. I will read each question only once. Please indicate the answer you think is best by marking in your test booklet.

10:30 Announcer
8:04 Announcer

Question number 1:

The lecture is primarily about

8:36 Announcer

Question number 2.

Which of the following is an example of the kind of semantic change described by the speaker?

12:02 Announcer
9:21 Announcer

Question number 3.

The English girl misunderstood the American girl's use of which of the following

words?

- 9:50 Announcer Question number 4.
 The speaker's story of the Mexican Sunday in East Lansing could illustrate all of the following points EXCEPT:
- 10:30 Announcer Question number 5.
 To which of the following aspects of language does "semantic" refer?
- 10:56 Announcer Question number 6.
 The speaker's use of the Latin terms for two shrubs indirectly points out that
- 11:28 Announcer Question number 7.
 The word "collaborator," which means coworker, now suggests "traitor" to many people. This is an example of
- 12:02 Announcer Question number 8.
 The speaker's final point is that an awareness of semantic change will
- 12:42 Announcer Question number 9.

Which of the following would be the best title for the lecture?

13:08 Announcer

Here is the second selection. It is a college lecture on hypnotism.

13:12 "Robert Hanna"

Before we get into the uses to which hypnotism is put, let me remind you of a few of the points about hypnotism which we made last week. Incidentally, I'll test you on these; I won't, however, hold you responsible for the history of hypnotism, although your text spends a chapter on it. You should remember the name "Mesmer," since many people still call hypnotism "mesmerism."

You will recall that I pointed out that hypnotism should not be equated with such occult speculations as telepathy or clairvoyance, nor with stage entertainments such as juggling and conjuring. (The stereotype of the hypnotist as one possessing evil powers is, of course, false--probably DuMaurier's "Svengali" is to blame.) While we don't really know why certain phenomena happen--how hypnotic suggestion is able to anesthetize, for example--we have unshakable

evidence that they do happen, which is more than we can now say about telepathic demonstrations--and I am familiar with Professor Paine's work on extrasensory perception.

Remember that most theatrical demonstrations of hypnosis are fraudulent--they depend either on confederates who are chosen as subjects, or on nerve pressure, which includes sleep, all right, but not hypnotic sleep. Hypnosis works on the unconscious, not the nerves.

The first important use of hypnosis is in dealing with the mentally disturbed. You will remember that Freud studied with Charcot, who used hypnotism on his patients, and that Freud's early psychoanalytic experiments relied heavily on hypnosis. He soon rejected hypnotism, and began using free association of ideas and dream analysis. What is important to remember here is that hypnosis is a technique designed to lull the conscious, so that the subconscious can take over. Under hypnosis a subject can recall things--an episode that happened when he was three, for example--that he normally has no recollection of, and the analyst can deal

with these buried influences. Incidentally, although hypnotism has been rejected by most analysts as a working tool, largely because of Freud, I feel it has value for this purpose, and my new book will document my position.

Secondly, hypnosis is being used increasingly in surgery. In most cases the patient is put into a complete hypnotic sleep, and it is suggested to him that he can feel no pain. Many amputations have been performed in this way, and many babies delivered without any other anesthetic. Several dentists have performed painless extractions--perhaps someday the novocaine needle will be obsolete. Hypnotism, I feel, would be used much more widely today for surgical purposes if it did not require special training, and if its use consumed as little time as administering a needle.

I want particularly to warn you against trying either hypnotism or nerve pressure yourself. You will harm yourself or others.

Next time we'll discuss posthypnotic suggestion, which deals with the hypnotic hold on a subject who has been apparently

		released from hypnotic control and seems perfectly free, but who reacts later to previously made suggestions. Read Chapter 5 on this subject and frame some intelligent questions before the next class meeting.
16:48	Announcer	Here are the questions for the second selection. Again I will read each question only once.
16:56	Announcer	Question number 1. The speaker discusses hypnosis in connection with the mentally disturbed primarily to show
17:24	Announcer	Question number 2. The speaker asks his students to prepare for the next class by
18:00	Announcer	Question number 3. What is posthypnotic suggestion?
18:34	Announcer	Question number 4. The speaker says that hypnotism and nerve pressure
19:00	Announcer	Question number 5.

The speaker feels that hypnotism would be used more commonly for surgery if

19:32 Announcer

Question number 6.

The speaker refers to "Svengali" to

20:06 Announcer

Question number 7.

The Professor Paine referred to in the selection is probably

20:34 Announcer

Question number 8.

The speaker said he will test the class on

21:02 Announcer

Now turn to page 2 of your test booklet and read along with me.

The purpose of the next section is to survey attitudes toward Robert Hanna, the speaker who read the two selections to you. You are asked to rate your personal attitude of how you feel toward the speaker on a series of scales. These scales are measures of meaning designed to obtain your general impressions. There are no "good" or "bad" ratings in the usual sense.

At each end of the scale is an adjective to describe the attitude you are rating. There are seven steps on each scale. A mark at either end on any scale means "extremely." A mark in the second position from either end of a scale means "quite." A mark in the third position from either end means "slightly." A mark in the middle position indicates a neutral or undecided feeling. Only one position should be checked on each of the scales, but please check each scale. Work at a fairly high speed and do not worry or puzzle over individual items.

Example #1: This mark indicates that the rater considers the speaker being rated "quite active."

Example #2. This mark indicates that the rater considers the speaker being rated "extremely unfair."

Remember, you are rating your attitude toward the speaker, not the speaker himself. Now turn to page 3 and fill in the scales.

22:46

Selections and questions taken from STEP Listening Test Form 1A.

Appendix C-1
THRESHOLD OF PERCEPTION

Example	Treatment	db Level	Number of Correct Responses*
1	White Noise	-50.0	1
2	Distortion	-30.0	2
3	Nothing	---	3
4	Distortion	-27.5	4 **
5	White Noise	-45.0	2
6	Nothing	---	4
7	Hum	-20.0	3
8	Distortion	-25.0	4
9	Hum	-15.0	4 **
10	White Noise	-40.0	4 **
11	Nothing	---	4
12	Distortion	-22.5	4
13	Nothing	---	3
14	Distortion	-20.0	4
15	Hum	-10.0	4
16	White Noise	-35.0	4
17	Distortion	-17.5	4
18	Hum	- 5.0	4
19	Nothing	---	4
20	White Noise	-30.0	4
21	Hum	0.0	4
22	White Noise	-25.0	4
23	Hum	+ 5.0	4
24	Nothing	---	4

* 4 panel members
 ** Operational Threshold of Perception

Appendix C-2

THRESHOLD OF OBLITERATION

Treatment	db Level	Number of Panel Members Unable to Distinguish Program*
White Noise	-20.0	0
White Noise	-15.0	0
White Noise	-10.0	0
White Noise	- 5.0	1
White Noise	0.0	3 **
White Noise	+ 5.0	3
Hum	-10.0	0
Hum	- 5.0	0
Hum	0	0
Hum	+ 5.0	0
Hum	-10.0	0
Hum	+15.0	0
Distortion	22.5	0
Distortion	20.0	0
Distortion	17.5	1
Distortion	15.0	3 **
Distortion	12.5	3
Distortion	10.0	3

* 3 panel members

** Threshold of Obliteration

Appendix D

PRE-TEST BOOKLET

NAME _____

(PRINT)

LAST

FIRST

MIDDLE

GRADE OR CLASS _____

SOCIAL SECURITY NO. _____

TODAY'S DATE _____

MONTH

DAY

YEAR

- | | | | |
|-------------|-------------|-------------|-------------|
| 1. A B C D | 11. A B C D | 21. A B C D | 31. A B C D |
| 2. E F G H | 12. E F G H | 22. E F G H | 32. E F G H |
| 3. A B C D | 13. A B C D | 23. A B C D | 33. A B C D |
| 4. E F G H | 14. E F G H | 24. E F G H | 34. E F G H |
| 5. A B C D | 15. A B C D | 25. A B C D | 35. A B C D |
| 6. E F G H | 16. E F G H | 26. E F G H | 36. E F G H |
| 7. A B C D | 17. A B C D | 27. A B C D | 37. A B C D |
| 8. E F G H | 18. E F G H | 28. E F G H | 38. E F G H |
| 9. A B C D | 19. A B C D | 29. A B C D | 39. A B C D |
| 10. E F G H | 20. E F G H | 30. E F G H | 40. E F G H |

1. (A) Regular attendance at other adult education courses and the primary motive of wishing to learn to listen
(B) A position of leadership in some group and a promise to attend six of ten class meetings
(C) Leadership of some group, regular attendance, and a strong desire to improve one's listening
(D) Regular attendance and a promise to lead other groups in listening training
2. (E) a phase of attention
(F) a physical preparation
(G) an attitude
(H) a personal relation
3. (A) a liking for people
(B) his attempt to remember what the speaker has said
(C) his evaluation of each point separately as it is made
(D) his attempt to respond intelligently to the whole message of the speaker
4. (E) Because the Leadership Clinic group asked for it
(F) Because the League of Women Voters and the Urban League demanded it
(G) Because a public opinion survey showed the need for it
(H) Because the speaker's research showed the need for it
5. (A) Good listeners react to the whole of what they hear.
(B) Mature people who try can rapidly improve their listening ability.
(C) Many leaders do not listen well.
(D) Listening can be taught.
6. (E) explain why this course in listening is being offered
(F) explain something of the nature of good listening
(G) list the requirements for enrolling in the course
(H) do all of these things
7. (A) The elevator man
(B) The soda-fountain girl
(C) The window shopper
(D) None of them
8. (E) Suspicion of strangers
(F) Resistance to change
(G) Susceptibility to influence
(H) Appreciation of the ridiculous
9. (A) Because he thinks the service will be poor
(B) Because he thinks it is unfair to labor
(C) Because he thinks he will be cheated
(D) We can't be sure.

10. (E) Humid
(F) Stormy
(G) Continuously hot
(H) It is impossible to tell
11. (A) "Other People's Business"
(B) "What's My Line?"
(C) "One Word Led to Another"
(D) "Words Without Music"
12. (E) improved
(F) limited in number
(G) carefully supervised
(H) absolutely prohibited
13. (A) left up to the students
(B) left to chance
(C) given in instructions
(D) decided in discussion between teacher and students
14. (E) That there is no justification for laboratory experiments in school
(F) That these experiments waste valuable class time
(G) That the suffering inflicted is needless
(H) That the teachers lose the respect of children by pretending to know less than they do
15. (A) controlled scientific experiments
(B) classroom experiments in controlled feeding
(C) a balanced diet for children
(D) encouraging children to love pets rather than human beings
16. (E) Students participating in these projects often become scientists
(F) Students participating in these projects usually have better diets
(G) Students participating in these projects tend to have court records
(H) Students participating in these projects are likely to become scholastic failures
17. (A) reasoning
(B) accumulation of evidence
(C) sentimental appeals
(D) objective description of the situation
18. (E) preferred working to holidays
(F) worked and played with enthusiasm
(G) turned with relief from work to play
(H) preferred rest to work or play

19. (A) from the cradle to the grave
(B) from her girlhood to the grave
(C) from her girlhood until she was sixty
(D) from her marriage until her husband's death
20. (E) tramping in the out-of-doors
(F) nursing sick people
(G) listening to complaining people
(H) keeping a garden
21. (A) when they were infants
(B) when they were children
(C) when they were adults
(D) when she was under sixty
22. (E) Because they do not have large families
(F) Because they aren't strong enough to face life
(G) Because they are unable to do as much work as she and her husband did
(H) Because every generation is discontented with the next
23. (A) She is alive.
(B) She is alive but on her deathbed.
(C) She is dead.
(D) One cannot tell from the poem.
24. (E) had the usual lovers' quarrels
(F) liked living together
(G) were never ill
(H) lived a grim and joyless life
25. (A) is tired of life
(B) is discontented with what life has given her
(C) regrets that she no longer has a useful role in life
(D) is satisfied with what life gave her
26. (E) immoral
(F) unrealistic
(G) unintelligible
(H) ironic
27. (A) a sign of intelligence
(B) a substitute for thinking
(C) a cause of optimism
(D) a cause of human suffering
28. (E) Men are now suffering.
(F) Men always have suffered and always will suffer.
(G) Man's suffering is a mockery.
(H) Optimism causes suffering.

29. (A) People with little intelligence
(B) Average people
(C) People of high intellect
(D) None of these
30. (E) it is a word without meaning
(F) the world is essentially evil
(G) there is so much human suffering
(H) it reflects illogical thinking
31. (A) gain a better understanding of different values
(B) agree with him that spiritual values are more important than material values
(C) begin an enduring effort to acquire spiritual values
(D) abandon the pursuit of material values
32. (E) A home is of little importance, but getting along with your husband is important.
(F) If one is to develop spiritually, one should not desire things like Georgian houses.
(G) Attention to material things prevents spiritual development.
(H) Spiritual development demands deliberate effort.
33. (A) That most of them believe in materialism
(B) That most of them are living by materialistic values
(C) That most of them have rejected spiritual values
(D) That many of them are already developing spiritual values
34. (E) a statement of the main point of his whole talk
(F) a humorous story used to gain attention
(G) an incident which illustrated his purpose
(H) a reference to the chief person in his talk
35. (A) reference to the interests of the audience
(B) reference to authority
(C) illustration from his own experience
(D) reference to the audience's desire for self-preservation
36. (E) illustrative detail
(F) formal reasoning processes
(G) emotional appeals
(H) anecdote

Appendix E

EXPERIMENT TEST BOOKLET

INSTRUCTIONS

1. Please be seated in booth number _____.
2. Turn the knob in front of you labeled "mic" counter-clockwise until it clicks off. (It may already be in the "off" position.)
3. Put on the headphones.
4. The experiment will begin soon. Some music will be played prior to the experiment; take this time to fill in the information at the bottom of this page. Also, adjust the volume control to a comfortable listening level. It is very important that you do not adjust your headphones during the experiment.
5. The announcer (on tape) will give you instructions for the experiment; please listen carefully.
6. Please do not talk while in the lab.

NAME _____
 (last) (first) (middle)

SOCIAL SECURITY NUMBER _____

To your knowledge, do you have any severe hearing loss?

_____ Yes _____ No

Question number 1:

- the misunderstanding that words can cause
- some unusual words and their meanings
- how word meanings can change
- the key features of English grammar

Question number 2:

- The word "role" can be spelled in two ways.
- The word "bus" is a shortening of the original "omnibus."
- The word "nice" originally meant "fine" or "subtle."
- The word "verily" is rarely used today.

Question number 3:

- Suppose
- Must
- See
- Every

Question number 4:

- Languages are characterized by regional peculiarities.
- Meaning can change from place to place.
- The same thing can be called by more than one name.
- The speaker may mean more than one thing by a name.

Question number 5:

- Origin
- Sounds
- Meaning
- Structure

Question number 6:

- The speaker is trying to impress his audience.
- English words have Latin origins.
- Some words make clearer distinctions than others.
- All of the listeners have studied Latin.

Question number 7:

- elevation
- verbal relationship
- degradation
- semantic error

Question number 8:

- make us more conscious of the derivations of words
- alert us to possible confusions in what we say or hear
- help us to understand the effect of grammar on meaning
- make us more cautious about the free exchange of ideas

Question number 9:

Page 1
(continued)

- "Time, Place, and Meaning"
- "Words, Words, Words"
- "What's the Good Word?"
- "Language and Learning"

The answer choices for the second reading are on the next page.

Question number 10:

- A memory of what went on while one was hypnotized
- A susceptibility to suggestion after one has been hypnotized
- The carrying over after hypnosis of something suggested during hypnosis
- A tendency to fall into the hypnotic state

Question number 11:

- absent or slight principles
- produce effects that are similar
- do not be considered as
- are used in a similar way

Question number 12:

- Freud's rejection of hypnosis had not affected doctors
- other anaesthetic words were not used
- its use was not so dangerous
- it did not require so much time

Question number 13:

- show his influence on Freud
- illustrate a misconception of hypnotism
- interest students in reading the book
- show the historical development of hypnotism

Question number 14:

- an authority on hypnotism
- an authority on therapeutic demonstrations
- an authority on psychoanalysis
- a popular, theater-type hypnotist

Question number 15:

- last week's lecture
- the history of hypnotism
- this week's lecture
- all of these

This concludes the questions for the second reading; please await further instructions.

Question number 1:

Page 1A

- that Charcot and Freud used hypnotism
- that hypnosis is a cure for many mental disorders
- that sources of disturbance may be revealed under hypnosis
- that psychoanalysis depends on dream analysis

Question number 2:

- framing a paper on the uses of hypnotism
- reading a chapter on hypnosis and surgery
- discussing post-hypnotic suggestions
- reading a chapter and drawing up questions

Question number 3:

- A memory of what went on while one was hypnotized
- A susceptibility to suggestion after one has been hypnotized
- The carrying out, after hypnosis, of something suggested during hypnosis
- A tendency to relapse into the hypnotic state

Question number 4:

- depend on similar principles
- produce effects that appear similar
- depend on confederates
- are used in psychoanalysis

Question number 5:

- Freud's rejection of hypnotism had not affected doctors
- other anesthetics were not so common
- its use was not so dangerous
- it did not require so much time

Question number 6:

- show his influence on Freud
- illustrate a misconception of hypnotism
- interest students in reading the book
- show the historical development of hypnotism

Question number 7:

- an authority on hypnotism
- an authority on telepathic demonstrations
- an authority on psychoanalysis
- a popular, theater-type hypnotist

Question number 8:

- last week's lecture
- the history of hypnotism
- this week's lecture
- all of these

This concludes the questions for the second reading; please await further instructions.

Page 2

The purpose of the next section is to survey attitudes toward Robert Hanna, the speaker who read the two selections to you. You are asked to rate your personal attitude of how you feel toward the speaker on a series of scales. These scales are measures of meaning designed to obtain your general impressions. There are no "good" or "bad" ratings in the usual sense.

At the end of the scale is an adjective to describe the attitude you are rating. There are seven steps on each scale. A mark at either end on any scale means "extremely." A mark in the second position from either end of a scale means "quite." A mark in the third position from either end means "slightly." A mark in the middle position indicates a neutral or undecided feeling. Only one position should be checked on each of the scales, but please check each scale. Work at a fairly high speed and do not worry or puzzle over individual items.

EXAMPLE #1: This mark indicates that the rater considers the speaker being rated "quite active."

PASSIVE: _____ : _____ : _____ : _____ : _____ : X : _____ : ACTIVE

EXAMPLE #2: This mark indicates that the rater considers the speaker being rated "extremely unfair."

UNFAIR: X : _____ : _____ : _____ : _____ : _____ : _____ : FAIR

Remember, you are rating your attitude toward the speaker, not the speaker himself.

Now turn to page 3 and fill in the scales.

Page 3

Robert Hanna as a speaker:

UNFRIENDLY: _____: _____: _____: _____: _____: _____: _____: _____: FRIENDLY

EXPERIENCED: _____: _____: _____: _____: _____: _____: _____: _____: INEXPERIENCED

TIRED: _____: _____: _____: _____: _____: _____: _____: _____: ENERGETIC

UNTRAINED: _____: _____: _____: _____: _____: _____: _____: _____: TRAINED

HONEST: _____: _____: _____: _____: _____: _____: _____: _____: DISHONEST

BOLD: _____: _____: _____: _____: _____: _____: _____: _____: TIMID

UNSAFE: _____: _____: _____: _____: _____: _____: _____: _____: SAFE

QUALIFIED: _____: _____: _____: _____: _____: _____: _____: _____: UNQUALIFIED

HESITANT: _____: _____: _____: _____: _____: _____: _____: _____: EMPHATIC

KIND: _____: _____: _____: _____: _____: _____: _____: _____: CRUEL

MEEK: _____: _____: _____: _____: _____: _____: _____: _____: AGGRESSIVE

SKILLED: _____: _____: _____: _____: _____: _____: _____: _____: UNSKILLED

JUST: _____: _____: _____: _____: _____: _____: _____: _____: UNJUST

INFORMED: _____: _____: _____: _____: _____: _____: _____: _____: UNINFORMED

PASSIVE: _____: _____: _____: _____: _____: _____: _____: _____: ACTIVE

PLEASE TURN TO THE FOLLOWING PAGE WHEN YOU COMPLETE
THE SCALES.

Appendix F.1

TOTAL DATA - CONTROL GROUP

#	Listening	Comprehension	Vocabulary	Self-Confidence	Dynamic
1	28	12	23	29	25
2	24	12	23	29	25
3	24	12	23	29	25
4	24	12	23	29	25
5	29	14	24	30	26
6	22	11	22	27	23
7	20	10	21	26	22
8	22	11	22	27	23
9	22	11	22	27	23
10	22	11	22	27	23
11	22	11	22	27	23
12	23	12	23	28	24
13	23	12	23	28	24
14	23	12	23	28	24
15	23	12	23	28	24
16	23	12	23	28	24
17	23	12	23	28	24
18	23	12	23	28	24
19	24	13	24	29	25
20	26	15	26	31	27
21	24	13	24	29	25
22	25	14	25	30	26
23	24	13	24	29	25
24	27	16	27	32	28
25	27	16	27	32	28
26	27	16	27	32	28
27*	30	19	30	35	31
28*	32	21	32	37	33
29*	30	19	30	35	31
30*	30	19	30	35	31
Mean	25.35	12.65	23.26	29.51	25.58
Variance	5.88	4.33	14.27	14.00	10.17

*These data were removed prior to final analysis.

Appendix F-1

TOTAL DATA - CONTROL GROUP

x	Listening	Comprehension	Safety	Qualification	Dynamism
1	28	14	23	31	28
2	24	16	25	30	27
3	22	13	28	30	22
4	26	13	24	31	25
5	29	12	19	30	24
6	22	12	22	28	25
7	20	12	31	29	28
8	20	8	18	24	25
9	21	14	24	28	15
10	25	10	26	30	27
11	26	13	26	35	29
12	26	13	18	27	26
13	29	13	27	35	24
14	24	9	24	33	26
15	25	11	25	25	27
16	27	17	29	33	29
17	25	13	22	31	30
18	28	12	25	30	29
19	28	10	31	34	26
20	26	11	24	33	25
21	28	14	27	26	25
22	25	14	24	29	29
23	24	14	20	35	26
24	27	12	21	19	23
25	27	16	21	27	20
26	27	14	27	32	25
27*	30	13	21	29	24
28*	32	17	24	30	22
29*	30	14	24	26	22
30*	30	16	21	30	26
Mean	25.35	12.69	23.88	29.81	25.58
Vari- ance	6.88	4.38	14.27	14.00	10.17

*These data were removed prior to final analysis.

Appendix F-2

TOTAL DATA - HUM TREATMENT

x	Listening	Comprehension	Safety	Qualification	Dynamism
1	21	15	16	23	17
2	22	13	32	29	23
3	28	13	29	31	26
4	21	11	31	34	30
5	25	10	23	31	28
6	26	14	30	34	25
7	28	15	25	35	30
8	26	13	32	31	30
9	29	16	23	29	24
10	22	8	27	31	21
11	24	12	29	32	25
12	25	15	28	28	28
13	24	15	22	29	23
14	20	13	25	31	21
15	22	15	24	34	27
16	29	15	22	25	25
17	27	14	22	33	27
18	25	12	22	34	24
19	24	13	22	29	26
20*	18	13	20	28	20
21*	19	14	24	33	20
22*	19	12	20	17	17
23*	19	11	26	34	26
24*	19	11	20	30	22
25*	16	8	31	32	23
Mean	24.63	13.26	25.47	30.68	25.26
Variance	7.80	4.09	18.60	10.01	11.54

*These data were removed prior to final analysis.

Appendix F-3

TOTAL DATA - WHITE NOISE TREATMENT

x	Listening	Comprehension	Safety	Qualification	Dynamism
1	27	13	29	30	24
2	26	14	20	28	24
3	26	10	31	32	31
4	21	11	26	32	25
5	24	11	31	32	31
6	26	15	22	29	30
7	27	14	31	35	26
8	24	14	25	31	22
9	28	7	27	29	23
10	25	11	23	24	27
11	24	13	22	30	28
12	28	13	21	26	21
13	28	15	27	30	28
14	25	12	25	34	25
15	24	14	29	26	27
16	26	13	21	25	14
17	26	14	19	26	28
18	24	13	32	34	31
19	25	12	24	29	22
20	29	15	23	30	25
21	20	10	28	28	27
22	23	12	22	25	22
23	29	13	29	30	24
24	23	11	20	13	13
25	21	14	20	34	27
26	24	10	21	29	18
27*	17	15	27	30	26
28*	18	11	21	25	16
29*	17	15	26	29	22
30*	30	14	30	30	28
31*	16	9	22	28	20
Mean	25.11	12.46	24.92	28.50	24.73
Vari- ance	5.71	3.70	16.72	18.50	21.57

*These data were removed prior to final analysis.

Appendix F-4

TOTAL DATA - DISTORTION TREATMENT

x	Listening	Comprehension	Safety	Qualification	Dynamism
1	26	14	23	27	25
2	28	16	29	30	28
3	25	12	17	19	24
4	25	15	31	31	26
5	22	9	23	28	21
6	24	16	26	34	28
7	26	12	22	27	24
8	27	12	31	31	29
9	23	16	26	31	26
10	24	14	18	30	26
11	25	13	24	32	26
12	28	15	26	35	28
13	25	13	31	35	28
14	25	6	20	31	18
15	29	13	22	28	25
16	23	13	20	22	25
17	21	13	23	26	24
18	24	12	26	29	27
19	28	14	22	28	27
20	23	8	25	25	23
21*	31	14	23	24	27
22*	30	15	23	29	25
23*	30	12	23	30	28
24*	32	15	23	28	29
25*	30	15	22	25	24
26*	17	13	30	22	24
27*	30	13	20	19	22
28*	17	11	31	33	32
Mean	25.05	12.80	24.25	28.95	25.40
Variance	4.68	6.91	16.83	16.26	6.99

*These data were removed prior to final analysis.

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