WITHIN-CHANNEL REDUNDANCY VERSUS BETWEEN-CHANNEL REDUNDANCY
IN INSTRUCTIONAL MATERIAL AND ITS ASSOCIATION WITH AMOUNT LEARNED

DISSERTATION

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By

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The problem of this study is whether between-channel redundancy in an instructional audio-visual message enhances immediate recall of information more than within-channel redundancy. A secondary purpose was to compare three forms of between-channel redundancy: audio-video, audio-video-caption, and audio-caption with one form of within-channel redundancy: video-caption. These comparisons were designed to demonstrate which form of redundancy had a higher association with recall of information.

The subjects were administered the Kentucky Comprehensive Listening Inventory to measure listening skills, and the Receiver Apprehension Inventory to identify subjects who experienced significantly high apprehension as receivers of information. Then the subjects were randomly divided into four treatment groups and shown an eight minute newscast. All four groups were presented the same instructional message, but the mode of presentation differed depending upon the treatment group. After viewing the instructional program each member of each group
was given a forty item multiple-choice retention inventory based on the information presented in the newscast.

The data were presented in terms of correct responses on the Kentucky Comprehensive Listening Inventory and the forty item retention inventory. Discriminate analysis was used to determine which items from the multiple-choice retention inventory accounted for the most variance. Thirteen items were found to account for the greatest amount of variance. Reliability estimates were calculated for all four story categories and for the forty items collectively. All reliability estimates were acceptable.

A close examination of the test scores, means, and treatment groups illustrated that treatment Group I, audio-video, did produce a significant difference from the other three treatment groups. Treatment Group III, audio-caption, edged out treatment Group II, audio-video-caption. This was expected because Group II required that one channel, sight, use two sources of information, the visual picture and the caption. Overall, between-channel redundancy produced higher means and higher test scores than did within-channel redundancy, all other factors being equal.
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CHAPTER I

INTRODUCTION

People are bombarded daily by information from verbal and non-verbal messages. McGroskey and Wheeless viewed information "as the meaning we assign to some stimulus that reduces our uncertainty about something. Information, like meaning, is not inherent in messages; rather, information is the product of messages and the way we process those messages to determine their meaning" (17). Television messages can be one source of information. With ninety-eight percent of all households in the United States owning a television set and the average American spending six hours, thirty-six minutes a day viewing (20), the potential for information transfer exists. An important issue is not whether information transfer occurs via television but the determination of the most effective mode of presentation. The television producer, instructional media writer, instructional media producer, filmmaker, audiovisualist and others concerned with audio-visual programs are inclined to believe that the audio-visual complex communicates more effectively than audio alone.
But the presumed communicative efficiency of audio and video is being questioned (1). Travers (23) suggested that for instructional purposes, single channel, or audio, is most appropriate. Broadbent (8) concluded that although information can be delivered simultaneously to two sensory channels, the ultimate perceptual processing system admits information only from a single channel at a time. Broadbent (6) further theorized that information processing occurred through a single channel with either the audio or video portion of a message being dominant. Hsia (18) asked if redundancy is the missing ingredient to the information process. Hsia (18) suggested that multi-channel (audio and visual) presentations may be ineffective in terms of information recall due to the lack of between-channel redundancy of the message. Thirty years of experimentation and speculation have failed to directly address this issue.

Is the reason audio-visual instructional material must compromise one sensory channel due to that lack of between-channel redundancy? Baldwin (1) believed future research should focus on between-channel redundancy of instructional messages. Hsia (18) stated that "the key to better human communication seems to lie in the determination of the optimal redundancy rate and the extensive use of between-channel redundancy. Between-channel redundancy, which possesses all the merits of other forms of redundancy and the demerits of none, seems ideally suited to serve as the key to better communication" (18, p. 81).
STATEMENT OF THE PROBLEM

The problem of this study was whether between-channel redundancy in an instructional audio-visual message enhances immediate recall of information more than does within-channel redundancy.

PURPOSE OF THE STUDY

The purposes of this study were to study:

1. within-channel redundancy of an instructional audio-visual message and its relationship with immediate recall,

2. between-channel redundancy within an instructional audio-visual message in three forms:
   a. audio and video
   b. audio, video, and caption
   c. audio and caption,

3. the three forms of between-channel redundancy individually and collectively and the relationship of each with immediate recall, and

4. within-channel redundancy's relationship to immediate recall versus between-channel redundancy and its relationship to immediate recall. Between-channel redundancy will be compared to within-channel redundancy collapsing across the three forms of between-channel delivery.
RESEARCH QUESTIONS

The following research questions were addressed in this study.

1. What is the relationship between immediate recall and within-channel redundancy (video and caption)?

2. What is the relationship between immediate recall and between-channel redundancy in the delivery form of audio and video?

3. What is the relationship between immediate recall and between-channel redundancy in the delivery form of audio, video, and caption?

4. What is the relationship between immediate recall and between-channel redundancy in the delivery form of audio and caption?

5. What is the relationship between immediate recall and between-channel redundancy collapsing across the three delivery systems?

6. What is the relationship between immediate recall and within-channel redundancy and immediate recall and between-channel redundancy?

DEFINITION OF TERMS

The following terms have restricted meaning and are thus defined for this study:
1. **Within-channel redundancy**—repetition of a signal or message within the same sensory channel.

2. **Between-channel redundancy**—repetition of a signal or message through two or more alternate sensory channels.

3. **Amount learned**—the immediate recall of information.

4. **Caption**—printed words appearing on the television monitor.

**BACKGROUND AND SIGNIFICANCE OF THE STUDY**

Henneman asked the question: "do the eyes or the ears afford the more efficient sensory channel through which to present information" (12, p. 163)? Henneman stated:

that renewed interest in the question has developed recently from a widespread emphasis on effective communication in the broad sense of the term and from the introduction of television into the American home. Although the success of both sound motion pictures and home television would imply that concurrent audio-visual presentation is highly effective, to provide the simultaneous input of information through both senses is not always practicable. Particularly in communication between individuals, a practical choice must often be made between the visual and the auditory presentation of information. Many purposes of communication require knowledge of the specific conditions determining the relative effectiveness of receiving information through the two senses (12, p. 163).

Turning to the experimental literature, investigations have been conducted principally in the field of educational psychology to discover the relative advantage of visual and aural...
presentation for the learning and retention of various types of material (10). Other studies have dealt with a comparison of the two senses in relation to a radio audience. The experimental results have been far from conclusive. Henneman concluded that at least five factors influence the relative advantage of presentation through the two senses:

1. Type of material presented (subject matter, form, length),

2. Method of presentation (sequential or simultaneous, single or repeated, long or brief exposure),

3. Intelligibility or comprehension measure employed (immediate recall, delayed recall, recognition, number of trials to learn),

4. Characteristics of the perceiver (age, intelligence, educational level), and

5. Environmental conditions of presentation (degree of noise, distracting occupation) (12, p. 163).

Broadbent (7) designed an experiment using the audio and visual channels. In one condition, two different digits were presented simultaneously, one to the right ear and the other to the eyes. After the third pair of digits, the subject was instructed to write them down in any order. In the second condition, subjects were given three digits successively in the right ear as before, but the visual digits were exposed all at
once, appearing as soon as the first aural digit and disappearing after the third. Subjects were able to correctly recall the digits from both channels fairly consistently and it was found that all information from one channel was reproduced before the other.

The conclusion that audio-visual material is better than audio or video alone is supported by two theories. The first is the cue summation theory which suggests that the stimulus cues in each channel are additive in their effect on information processing. Miller et al. stated: "When the cues elicit the same responses simultaneously, or different responses in proper succession, they should summate to yield increased effectiveness" (18, p. 78). A second theory attributes a reinforcement effect to related stimuli presented simultaneously in two channels. Gropper (11) concluded that when the audio and visual channels are closely related in terms of content, each presents cues which elicit responses that are reinforced almost immediately in the other channel. Mowbray (19) demonstrated the concept of simultaneously presenting material to two sensory channels by reciting different prose passages simultaneously in auditory and visual channels. He concluded that: "...as alternation of attention becomes increasingly more difficult, the possibility of performing adequately both of two simultaneous perceptual tasks becomes more remote" (19, p. 371). Bernstein attempted to answer
the question: "can we see and hear at the same time" (3, p. 22)? with studies of intersensory facilitation of reaction time. Bernstein stated that visual reaction time is "facilitated by a simultaneous or near simultaneous auditory event. This finding poses a problem for proponents of a single channel theory of attention since the auditory and visual events should be mediated by different input channels, only one of which is accessible to attention and processing at a time" (3, p. 22). The purpose was to describe some recent studies concerned with the phenomenon of intersensory facilitation of reaction time and relate these to single channel theories. Although single channel theories are well known from studies of the psychological refractory period, time estimation, dichotic listening, and the like, differences among specific theories suggest the need for definition of terms. Bernstein followed Kristofferson whose position is: "attention is thought of...as the result of a gating mechanism which controls the flow of information from the sensory display areas into a central data processor. The gating is all or none; the central processor being open to one and only one display area of channel at any instant" (3, p. 22). Bernstein also used Kristofferson's definition of a channel as "a set of all possible messages which can be admitted simultaneously into the central processor" (3, p. 22). However, Bernstein (3) did not want to limit single channel theories to those, like Kristofferson's, in which the minimal period of attention is fixed as the by-product of an internal
clock, or to necessarily exclude attenuation theories as proposed by Treisman (24) from consideration as single channel theories.

O'Donnell (21) examined the recall of a televised message as a function of the individual viewer's motivation. The more attention given to the instructional material, the more information recalled. O'Donnell (21) concluded that viewer motivation was a mediating variable in the learning process using audio-visual material. Cornell (9) theorized that simultaneous use of audio and visual instructional information would accentuate retention if they were redundant and interfere with retention if instructional film and television material should present the audio and visual messages simultaneously and avoid presenting a message in one modality simultaneously with a non-redundant message in the other modality. The relationship between the text and visual image in comprehending a foreign language using televised instructional material was examined by Kraif (15). It was found that redundant images can enhance comprehension of an oral foreign language text.

Berry (4) argued that behavioral researchers and instructional program producers need to design better educational materials for adults so that the information can be better understood, learned, and recalled by the adult learner. Berry (4) emphasized that learner characteristics and production variables must be considered at all times in designing instructional material. Videotaped instruction can improve the encoding or
Still pictures or slides may be used to aid learning and recall of cause-and-effect relationships within subject matter. In the area of story comprehension, Beagles-Roos (2) concluded that recall of story details was improved with a televised presentation. Recognition of expressive language or dramatic dialogue was improved by using only audio, whereas picture sequencing was increased by an audio-visual story. Beagles-Roos' (2) findings emphasized the importance of considering the differential impact of audio-visual versus audio for teaching implicit and explicit information.

Stauffer (22) determined that cuing an audience to pay attention to specific items of information or to achieve specific learning objectives produced better recall of instructional material. In addition, cued subjects were able to recall more details of the audio-visual material than the non-cued subjects. As Hsia (14) concluded, audio-visual comparison studies based on available research represent a confusing picture with respect to the efficacy of the audio and visual channels. Summarizing, Hsia stated: "Man is a multiple-channel organism when input is optimal. In other words, he is capable of processing information through multichannels, so long as the inflow is within the limit of his information processing capacity. When input is far beyond his information processing capacity, it is possible that man may
act as a single communication channel" (14, p. 65). Haia (14) reasserted in his conclusion, audio-visual research must be directed toward between-channel redundancy, information processing, and the retrieval of information from short-term memory.

PROCEDURES FOR COLLECTING DATA

The two primary aspects of this study involve the audio and visual segments of a televised program and the presence and absence of interdependency to one another. Thus, the subjects, psychology and communication undergraduate students, must possess the ability to listen to an audio message. To assess listening skills the Kentucky Comprehensive Listening Inventory (KCLI) was administered to each subject. The test involves four parts and produces five measures (See Appendix A). The KCLI was tested using basic public speaking students at the University of Kentucky. Its reliability was .75, producing a t of 3.711, significant at the .01 level (5). Wheeless (25) concluded that the Receiver Apprehension Inventory (RAI) construct deals with inadequate processing of information (See Appendix B). This measure indicates which subjects experience significantly high apprehension as receivers of information.

The televised program used for the study was a modified instructional broadcast edited to approximately eight minutes in
length. None of the subjects had been exposed to the news stories or the news reporters. This was done to keep the content constant and to examine the effect of between-channel and within-channel redundancy of the message on immediate recall of information. After successfully completing the listening inventory and receiver apprehension inventory, the subjects were randomly divided into four groups of approximately twenty persons per group. All four groups were presented with the same instructional message, but the mode of presentation differed for each group:

- Group I—Audio and Video
- Group II—Audio, Video, and Caption
- Group III—Audio and Caption
- Group IV—Video and Caption

After viewing the instructional program each member of each group was given a multiple-choice test based on the information presented in the program (See Appendix C). The multiple-choice items (using a five-response format) were developed for each story contained in the message. The audio-visual program contained four stories: basketball, football, hockey, and weather; ten questions were developed for each story for a total of forty items.

PROCEDURES FOR ANALYSIS OF DATA

After all subjects completed the forty item multiple-choice test and all retention data had been collected, the
subjects' responses were item analyzed (regardless of treatment condition). The item analysis was completed for each group of items related to each story contained in the message. Story retention items were eliminated based upon item difficulty/discrimination indices, and alpha reliability estimates for the remaining items were computed. F values determined significance among all four groups.
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CHAPTER II

REVIEW OF RELATED LITERATURE

Teaching Contributions of Television

In the 1950s, Schramm (15) asked the question "can television teach" (15, p. 12)?; but the medium has clearly demonstrated its broad usefulness, and the question now is "how and what can television teach best" (15, p. 12)? An emerging theory, somewhat different from the obvious one, is that television, used at its best, could teach some things very well. For example, in teaching verbal knowledge, Schramm (15) contended that television made five significant contributions.

1. Television provides a meaningful context so that new names and definitions can be retained and used. McLuhan stated "that you can tell someone what a bucket is, but he will never really understand until he sees a bucket or a picture of it" (15, p. 12).

2. Television can illustrate a process and the necessary discriminations set forth concretely. Gagne (15) believed that television could be especially helpful in recalling the necessary rules and concepts and the procedures for applying them (15, p. 12).
3. Television can be very useful in motor skills in recalling the necessary physical or motor routine. For example, one can hardly learn to throw a curve with a baseball solely from watching the television picture of someone throwing a curve, but the picture can illustrate the routine and thus make it easier to learn and recall the kinesic procedures that must be mastered by actual practice (15, p. 13).

4. Television can be substantially useful in learning cognitive strategies such as problem solving. Television can assist in recalling the rules and concepts that enter into the strategy and in helping the learner transfer the strategy to new situations by showing concrete examples of its application. Schramm believed this is particularly important in extending and applying new learning (15, p. 13).

5. Television can contribute significantly to the learning of values and attitudes by presenting situations where one behavior must be chosen rather than another and by presenting models of the desired behavior that can be admired and identified with (15, p. 13). Schramm stated:

There is a common thread in all these uses of television. It is the concreteness of the medium. Television can provide a concrete and meaningful context in which to learn names, definitions, other verbal knowledge. It can provide concrete illustrations of the kinesic routines involved in motor skills. It can provide concrete illustrations of how cognitive strategies can be applied to new problems and new situations. And it can provide concrete
examples of situations of choice that put flesh and blood on the abstractness of values and attitudes (15, p. 13).

Schramm (15) challenged the producer of instructional television material to determine where this kind of concreteness is needed (as opposed to the abstractness of words and numbers) and where it can best be presented through the codes of television rather than direct observation or practice.

Instructional Message Design

Audio vs. Audio-Visual

Television, a teaching medium, is a combination of audio and visual modes of presentation with the ability to transmit a message through multiple sensory channels. However, early proponents of the single channel theory of communication believed a choice had to be made between visual and audio presentations. Henneman (10) suggested that the communicator has two potential sources of information in preparing an answer of which sense is the more efficient sensory channel:

1. a survey of the literature reporting experimental comparisons of the two senses, and

2. a theoretical analyses of the known facts of visual and auditory perception (10, p. 264).

Turning to the experimental literature, Henneman (10) found that the investigations have been conducted principally in the area of educational psychology to discover the relative advantage
of visual and aural presentation for the learning and retention of various types of material (8). Other studies have dealt with a comparison of the two senses from the standpoint of the radio audience. The experimental results have been far from conclusive. Whether visual or aural presentation proves to be superior appears to depend largely upon the scientific experimental conditions of a particular investigation (2). Henneman (10) concluded that a survey of the research literature in this field did not provide the answers to the questions of the communicator. In order to determine the most efficient division of labor between the visual and auditory senses for communication purposes, one is compelled either to make the most educated guesses possible from a theoretical analysis of the known facts of perception, or to undertake a program of laboratory experimentation (9).

A theoretical comparison of the two senses from the experimental psychology of visual and auditory perception is more fruitful than a survey of the literature in suggesting basic differences which can be utilized for various specific purposes of communication. In the comparison, auditory presentation will usually imply stimulation by speech, rather than by any other type of auditory signals. Henneman (10) offered in summary form, for purposes of communication, the most valuable features of the auditory sense channel appear to be:
1. Flexibility,
2. Selective presentation, and
3. Attention-demandingness (10, p. 265).

On the other hand, the most useful characteristics of visual presentation are:

1. Referability,
2. Adaptability for presenting relational information,
3. A faster rate of presentation, and
4. Greater variability of dimensions where discrimination must be exercised among many small differences (10, p. 265).

Henneman (10) concluded that when the observer's attention is divided, messages presented aurally are more intelligible than those presented visually.

Bernstein (4) concentrated on single channel theories of communication. However, Bernstein (4) did not want to limit single channel theories to those, like Kristofferson's (12), in which the minimal period of attention is fixed as the by-product of an internal clock, or to necessarily exclude attenuation theories as proposed by Treisman (19) from consideration as single channel theories. Bernstein (4) pointed out that in attenuation theories, input from subsidiary or unwanted channels is processed along with stimulation from wanted channels. Unwanted input, as it is effectively weaker, is less likely to pass certain preliminary tests. As a result, such input is subject to less extensive analysis than wanted input. "Attenuation may be
accomplished by aligning attention on the wanted channel for some proportion greater than five-tenths of the time, and on the unwanted channel the remainder of the time, rapidly alternating between the two" (4, p. 21). Studies of simple and discriminative reaction time suggest that the duration of the event critical in evoking visual reaction time is very short, less than fifteen msec for all but the lowest visible intensities (4, p. 21). Thus, a theoretical question arose as to how the A event, which in Bernstein's (4) studies was always the irrelevant event, could affect reaction time within a single channel theory of attention. Bernstein stated "a dilemma is thus created in that one may either assume that an irrelevant event can pass at the same time as the relevant event, thereby dropping the single channel assumption, or else may assume that a non-attended, and therefore unprocessed, event can affect performance" (4, p. 21).

Introduction of Redundancy in Audio-Visual Message

In order to reconcile the discrepancy in his single channel theory, Bernstein (4) adduced two logically independent models, both of which assume a non-attentional parallel pathway with properties similar to those ascribed to the recticular formation. The first, or energy integration model, assumes that stimulus intensities may add across modalities causing the joint event to be effectively stronger than the visual event alone. The second or preparatory state model assumes that response preparation,
defined as a generalized disposition to make an overt response regardless of the specific nature of the response, may proceed in parallel with specific stimulus and response selection and may be initiated by non-attended stimuli (4, p. 23). Bernstein (4) found evidence in separate studies to support both models.

Weaver and Weaver (20) pointed out that it would be useful in communication research to specify the number of units of meaning-capacity in a message. For example, no one knows what proportion of the meaning sent is heard by a listener, simply because there is no way of measuring the amount sent. Weaver and Weaver (20) gave some definitional relationships between meaning and message: when used to refer to a message, it meant the capacity of the message to generate meaning in a listener. Information is used in two senses: as a bit of information to refer to the outcomes of Shannon's (16) formula, and as an item of information in the generally accepted sense. The objective of Weaver and Weaver's (20) study was to demonstrate that bits and items of information are not the same, that in communication the concern is with items and not bits, and that it is not possible to use Shannon's (16) formula to compute anything like the amount of meaning-capacity in a message. Weaver and Weaver (20) asserted that establishing a unit of meaning-capacity in a verbal utterance is not the same as quantifying the meaningfulness of a message to the receiver. How much does such a sentence as "It happened six days ago" mean to an individual? To answer this question, Weaver
and Weaver (20) suggested the semantic differential may be a better technique than information theory. Certainly neither the information computed in bits prior to transmission nor the meaning-capacity is an adequate measure of the meaning perceived. And thus even the same individual may perceive quite different amounts of meaning at different times from "It happened six days ago" (20).

Weaver and Weaver concluded that

1. The element of surprise in a message does not represent the capacity of the message to generate meaning in a listener. Surprise seems to represent some part of that capacity, but the proportion currently is unknown;

2. Although it is generally recognized that meaning is generated in the listener and resides within him, there exists no useful and reliable measure of the capacity of a message, even if it is stripped down to only its linguistic elements, to generate meaning (20).

Ashby (1) stated that in human communication, every constraint constitutes redundancy, because constraints are in fact redundant. Hsia (11) contended that the manipulation of redundancy is fundamental in communication. Without redundancy, no communication is intelligible; without redundancy no natural language could have been developed nor artificial language devised (11, p. 63). But redundancy has been generally overlooked, Hsia
stated, "probably because of the instant association of redundancy with repetition. Redundancy has, in fact, many forms and interpretations" (11, p. 64).

Hsia (11) pointed out the need for clarification and classification—the first step in the formulation of general redundancy laws. Clarification requires that the confusion in the definition of redundancy be eliminated. Hsia (11) pointed out that for some, redundancy is the information the various stimulus components share with one another; for others, redundancy is the information in excess of that necessary for the determination of certain specified naming or categorizing response (11). More rigorously, Garner (9) equated redundancy with contingent uncertainty in terms of distributional and correlational occurrence of alphabetic letters or words: the former can be the distributional occurrence of alphabetic letters or words, and the latter, the probable relations among words or letters. Hsia (11) also pointed out that the classification of various forms of redundancy is no less problematic than the definition. Redundancy is derived from entropy, or information; therefore, classification of redundancy may be exactly that of entropy. Hsia stated:

There is syntactic, semantic, and pragmatic information, so there must be syntactic, semantic, and pragmatic redundancies, all of which are within-channel redundancy. Both syntactic information and syntactic redundancy can be easily defined and calculated, as demonstrated by many information theorists. But information and
redundancy in semantics and pragmatics remain as elusive as ever, despite many painstaking efforts to formulate and formalize. In contrast with within-channel redundancy, between-channel redundancy, which may be defined as the redundancy rate between two channels, is characteristically different in its form, functions, and applications (11, p. 66).

The fundamental objective in communication is to achieve perfect information transmission and reception—perfect communication, a process in which participants create and share information with one another in order to reach a mutual understanding (14, p. 63). Rogers and Kincaid defined information as a difference in matter-energy which affects uncertainty in a situation where choice exists among a set of alternatives (14, p. 48). Perfect communication means that the information being transmitted, processed, and fed back suffers no equivocation and incurs no error (11). Redundancy functions to curtail equivocation, to reduce error to a tolerable level in both encoding and decoding processes, to lessen the effects of noise, interference, and distortion, to facilitate information association and discrimination, and to reduce forgetting or memory decay (11). Hsia stated:

Introduction of redundancy into a sign system invariably raises the cost of information processing in terms of time and space, because redundancy takes away message space that might otherwise be occupied by information. To reduce equivocation and error, it is necessary to increase redundancy; but to increase redundancy
is to decrease information. This is the dilemma of communication (11, p. 69).

Hsia (11) believed that the existence of equivocation and error renders perfect communication impossible. By manipulating redundancy in a message between processing and memory and between channels, it appears possible to achieve relative maximum information transfer, taking into account information, error, and redundancy (11). Information and redundancy must be maintained at an optimal ratio to keep equivocation and error at a relative minimum and to keep the cost of information processing to a minimum. The maintenance of an optimal ratio between information and redundancy is of fundamental importance in communication and education. The key to better human communication seems to lie in the determination of the optimal redundancy rate and the extensive use of between-channel redundancy (11).

Research specifically dealing with televised messages and recall of information have centered around audio presentations versus audio-video presentations. O'Donnell's (13) investigation is grounded in uses and gratifications theory, which contended that media use is an expression of the individual viewer's motivation. The examination of news recall was explored in terms of viewer motivation, recall of stories and details from the evening national network newscasts, general media use, and demographic characteristics. Recall was found to be consistently related only to amount of attention given to the news. The more
attention given, the more news that was recalled (13). Cornell (7) examined the goal of increasing the effectiveness of educational films and television programs. A specially constructed videotape about animal behavior was interspersed with redundant audio and video messages and non-redundant messages. For some subjects, the audio and video were presented simultaneously, and for other subjects, the audio was paired with a blank screen and the video with silence. The subjects who viewed the redundant, simultaneous message showed a higher retention of information and confirmed a significant interaction between redundancy and simultaneity (7).

Berry (5) pointed out that the use of videotaped programs can enhance the encoding of news information and improve free recall. Beagles-Roos (3) conducted a cross-media comparison of television and radio to determine the specific strengths of each medium for transmitting information. Subjects were exposed to an animated audio-visual and audio story. Recall of the explicit story was equivalent across media. Recall of story details was improved with audio-visual presentation (3). Stauffer (17) concluded that cuing an audience to concentrate on specific items of information presented audio-visually resulted in better recall of televised material.

Redundancy, specifically between-channel redundancy, has not been compared with within-channel redundancy in terms of greater
recall of information. That is the purpose of this study. Hsia's (11) assertion that audio-visual research must be in the areas of between-channel redundancy, information processing, and recall of information were examined.
CHAPTER BIBLIOGRAPHY


4. Bernstein, I.H., "Can We See and Hear at the Same Time?" Acta Psychologica, XXXIII, (Spring, 1970), 21-35.


CHAPTER III

METHODS AND PROCEDURES FOR COLLECTION OF DATA

Selection of Subjects

The subjects used for this study were communication and psychology undergraduate students enrolled full-time at a four-year state university. A total of eighty-eight subjects was used for the study. The subjects were all juniors and seniors to minimize any problems that might occur from lack of testing experience. The mean age of the eighty-eight subjects was twenty-one years. This indicated that these subjects had had the opportunity to view television both as an entertainment medium as well as an educational tool in public school and/or in higher education. Groups I and II had eleven males and eleven females each; Group III, ten males and twelve females; and Group IV, nine males and thirteen females.

The eighty-eight subjects were randomly assigned to four groups of twenty-two subjects each:

Group I—Audio and Video
Group II—Audio, Video, and Caption
Group III—Audio and Caption
Group IV—Video and Caption
Description of the Instruments Used

Before dividing the subjects into four treatment groups, the Kentucky Comprehension Listening Inventory (KCLI) and the Receiver Apprehension Inventory (RAI) were administered to the participants. The KCLI measured five components of listening. Part One assesses short-term listening; Part Two, listening with rehearsal (items which are to be recalled after an intervening time period of fifteen to fifty seconds). Part Three measures interpretation or the understanding of personal relationships; Part Four, lecture listening. Part Five produces a distraction scale. This is determined by adding the number of correct responses from the last six items in Parts One and Two. These items contained interfering material so that this subscale measures the student's ability to concentrate on one stimulus (1). The RAI is a unidimensional construct with items related to informal-interpersonal and formal-public communication contexts. The RAI consists of twenty Likert-type items with five responses ranging from strongly agree to strongly disagree (3) (Appendix B).

In order to measure the subject's recall of information from the videotaped newscast, a comprehension test was developed. A multiple-choice test seemed to be the best format. Cook listed the following as advantages of the multiple-choice test:

1. Less open to guessing than the alternate-response items;
2. Adaptable to a wide variety of material;
3. Widely used and familiar to pupils;
4. Well adapted to measuring understanding, discrimination, and judgment (2).

Cook's suggestions for constructing objective test items were followed in the development of the test:

1. Only one type of multiple-choice item should be used in the same section of a test;
2. Use five possible responses in order to minimize chance successes;
3. Arrange the correct response to occur in the same position not more than two or three times in succession;
4. Formulate all the possible responses in such a way that they will appear plausible to all students below the ability level at which the item is intended to discriminate;
5. Make all possible responses the correct one in about equal numbers; and,
6. Avoid wording statements in such a way that clues are not provided through word matching or grammatical consistency (2).

The videotaped newscast contained four stories (Appendix D). Ten multiple-choice items were developed for each story and each of the five possible responses were used an equal number of times. Before the final version of the test was printed, the multiple-choice items were randomly arranged to prevent the preceding item from cuing the correct answer to the question currently under consideration.

Procedure for Collecting the Data

Subjects were instructed to attend one of three scheduled administrations of the instruments. Each session met in the same room to minimize differences in the room conditions, lighting, temperature, and acoustics. First, the subjects completed the
Receiver Apprehension Inventory. Second, the Kentucky Comprehensive Listening Inventory was presented. The KCLI was pre-recorded on a cassette tape. All instructions and appropriate pauses were already on the tape. Before the test began each subject was queried as to ability to hear the tape and the volume was adjusted appropriately. The KCLI was then administered.

After completion of the KCLI the subjects were randomly assigned to four treatment groups. Each group was shown the same newscast, on the same videotape and monitor. The only difference between newscasts was the mode of presentation:

- **Group I**—Audio and Video
- **Group II**—Audio, Video, and Caption
- **Group III**—Audio and Caption
- **Group IV**—Video and Caption

At the end of the newscast each subject was given a forty-item multiple-choice retention test designed to measure recall of information presented during the newscast. All subjects took the same test, regardless of group assignment.

Upon completion of the study, the twenty items of the RAI were summed so that each subject had a total score for the inventory. Each part of the KCLI was scored separately for each subject to produce five listening totals. The multiple-choice retention tests were computer-scored to determine the total number of correct responses for each subject. The subjects' individual scores on these three tests produced the data to be analyzed.
CHAPTER BIBLIOGRAPHY


CHAPTER IV
PRESENTATION OF DATA

It was the purpose of this study to investigate the relationship between immediate recall and between-channel redundancy and immediate recall and within-channel redundancy of a message. A secondary purpose was to examine three forms of between-channel redundancy in relation to immediate recall of information.

Kentucky Comprehensive Listening Inventory

The Kentucky Comprehensive Listening Inventory (KCLI) was administered to all eighty-eight subjects. The KCLI produced five scores: short-term listening, short-term listening with rehearsal, interpretation, lecture, and distraction. The total number of correct answers per section for each of the subjects was computed providing five listening scores for each subject. Using the Statistical Analysis System (SAS), a univariate frequency plot was produced for each of the five measures of the KCLI, using the scores of all eighty-eight subjects (regardless of treatment group) (1). Table I shows the frequency distribution of the correct answers on the short-term listening portion of the KCLI.
On the short-term listening inventory, twelve was a perfect score. From the data in Table I, the mean was 6.89 with a standard deviation of 2.01. The second area of the KCLI was short-term listening with rehearsal. In short-term listening with rehearsal, the subjects are exposed to a series of letters or numbers followed by pauses of varying lengths. Then the subjects are asked to recall a specific letter or number based on its
position in the series. Table II shows the frequency distribution of the correct responses on the short-term listening with rehearsal inventory.

**TABLE II**

FREQUENCY TABLE OF CORRECT ANSWERS ON SHORT-TERM LISTENING WITH REHEARSAL INVENTORY

<table>
<thead>
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</table>

On the short-term listening with rehearsal inventory, twelve was a perfect score. From the data in Table II, the mean was 9.10 with a standard deviation of 1.96. The third section of the KCLI
dealt with the interpretation of information presented through a dialogue. The subjects were then asked to answer questions concerning this short dialogue between a man and woman. The subjects had to take into account information presented in the dialogue, tone of voice, inflection, and phrasing of information. Table III shows the frequency distribution of the correct answers on the interpretation section of the KCLI.

**TABLE III**

**FREQUENCY TABLE OF CORRECT ANSWERS ON INTERPRETATION LISTENING INVENTORY**

<table>
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<tr>
<td>Total</td>
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</table>
On the interpretation inventory, ten was a perfect score. This score was not achieved by any of the eighty-eight subjects. From the data in Table III, the mean was 5.89 with a standard deviation of 1.75. Lecture listening was measured in the fourth section of the KCLI. The subjects were exposed to a lecture on bi-lingual education in the United States. The lecture was

TABLE IV
FREQUENCY TABLE OF CORRECT ANSWERS ON LECTURE LISTENING INVENTORY

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<td>88</td>
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approximately ten minutes in length. At the conclusion of the presentation, the subjects were instructed to answer questions dealing directly with the information presented in the lecture. Table IV shows the frequency distribution of the correct answers on the lecture listening inventory of the KCLI. On the lecture listening, fourteen was a perfect score. The mean was 7.41 with a standard deviation of 1.89. The fifth category measured was the ability to listen and recall information while being distracted.

**TABLE V**

FREQUENCY TABLE OF CORRECT ANSWERS ON DISTRACTION LISTENING INVENTORY

<table>
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Total  88  ...            ...
During the last six questions of the short-term listening and short-term listening with rehearsal sections, the subjects were distracted (or an attempt was made to distract them) with a conversation between a man and woman. Table V presents the frequency distribution of the correct responses of the distraction factor. On the distraction listening inventory, twelve was a perfect score. From the data in Table V, the mean was 7.64 with a standard deviation of 2.34.

Newscast Story Categories

All eighty-eight subjects viewed the same news videotape. Only the mode of presentation was different; the information conveyed by the videotape was exactly the same for all four treatment groups. A forty item multiple-choice examination covering the information presented in the newscast was administered to each subject following the viewing of the videotape. There were four general categories of stories: basketball, football, hockey, and weather. Ten questions dealt with each of the general story areas for a total of forty questions. These questions were randomly ordered to minimize the opportunity for the subjects to get extra information or assistance from the other questions dealing with the same story area.

Table VI represents the frequency distribution of the correct answers on the basketball questions appearing in the multiple-choice examination.
On the basketball category, ten was a perfect score. Five subjects had the highest score of nine. From Table VI the mean was 5.28 with a standard deviation of 1.97. Table VII represents the frequency distribution of the correct responses on the football portion of the multiple-choice examination.

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TABLE VII
FREQUENCY TABLE OF CORRECT ANSWERS
ON FOOTBALL ITEMS

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</table>

Again ten was a perfect score on the football questions. Two subjects did achieve that mark. From Table VII the mean was 5.89 with a standard deviation of 2.24. Table VIII represents the frequency distribution of the correct answers on the hockey questions covered in the multiple-choice examination.
### TABLE VIII
FREQUENCY TABLE OF CORRECT ANSWERS
ON HOCKEY ITEMS

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<td>Total</td>
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</table>

With ten being the perfect score on the hockey questions, Table VIII shows that only one subject obtained the maximum score. The mean on the hockey questions was 4.92 with a standard deviation of 1.82.
The last story category was weather. Table IX shows the frequency distribution of the correct responses on the weather questions.

TABLE IX
FREQUENCY TABLE OF CORRECT ANSWERS ON WEATHER ITEMS

<table>
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</table>

Total 88  ...  ...

Overall, the eighty-eight subjects scored higher on the weather questions than they did on the other three story areas. Seven subjects had perfect scores of ten. The mean of all the subjects was 7.20 with a standard deviation of 2.05. Table X represents the frequency distribution of the correct answers on all forty items covered in the multiple-choice retention examination.
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<td>3</td>
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<td>16</td>
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<td>24</td>
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<td>27</td>
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<td>34</td>
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<tr>
<td>35</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cell (%)</th>
<th>Cumulative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>1.1</td>
</tr>
<tr>
<td>1.1</td>
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<td>1.1</td>
<td>3.4</td>
</tr>
<tr>
<td>2.3</td>
<td>5.7</td>
</tr>
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<td>4.5</td>
<td>10.2</td>
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<td>3.4</td>
<td>13.6</td>
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<tr>
<td>1.1</td>
<td>14.8</td>
</tr>
<tr>
<td>3.4</td>
<td>18.2</td>
</tr>
<tr>
<td>5.7</td>
<td>23.9</td>
</tr>
<tr>
<td>3.4</td>
<td>27.3</td>
</tr>
<tr>
<td>5.7</td>
<td>33.0</td>
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<tr>
<td>4.5</td>
<td>37.5</td>
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<tr>
<td>4.5</td>
<td>42.0</td>
</tr>
<tr>
<td>2.3</td>
<td>44.3</td>
</tr>
<tr>
<td>11.4</td>
<td>55.7</td>
</tr>
<tr>
<td>4.5</td>
<td>60.2</td>
</tr>
<tr>
<td>8.0</td>
<td>68.2</td>
</tr>
<tr>
<td>6.8</td>
<td>75.0</td>
</tr>
<tr>
<td>1.1</td>
<td>76.1</td>
</tr>
<tr>
<td>4.5</td>
<td>80.7</td>
</tr>
<tr>
<td>3.4</td>
<td>84.1</td>
</tr>
<tr>
<td>5.7</td>
<td>89.8</td>
</tr>
<tr>
<td>3.4</td>
<td>93.2</td>
</tr>
<tr>
<td>3.4</td>
<td>96.6</td>
</tr>
<tr>
<td>1.1</td>
<td>97.7</td>
</tr>
<tr>
<td>2.3</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Overall, the mean for all eighty-eight subjects, regardless of treatment group was 23.30 with a standard deviation of 6.46. The range for all scores was 27.
Item Discriminate Analysis

Next a stepwise discriminant analysis by forward selection was performed on the forty items of the multiple-choice examination by treatment group. The significance level entered was .1500. Table XI lists the forty items with their respective F statistics.

TABLE XI

FORTY ITEMS WITH F STATISTICS

<table>
<thead>
<tr>
<th>Variable</th>
<th>F</th>
<th>Prob &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.624</td>
<td>0.1884</td>
</tr>
<tr>
<td>2</td>
<td>1.174</td>
<td>0.3248</td>
</tr>
<tr>
<td>3</td>
<td>1.120</td>
<td>0.3461</td>
</tr>
<tr>
<td>4</td>
<td>1.917</td>
<td>0.1314</td>
</tr>
<tr>
<td>5</td>
<td>0.459</td>
<td>0.7155</td>
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<tr>
<td>6</td>
<td>3.455</td>
<td>0.0199</td>
</tr>
<tr>
<td>7</td>
<td>1.776</td>
<td>0.1564</td>
</tr>
<tr>
<td>8</td>
<td>3.373</td>
<td>0.0220</td>
</tr>
<tr>
<td>9</td>
<td>2.630</td>
<td>0.0545</td>
</tr>
<tr>
<td>10</td>
<td>2.519</td>
<td>0.0625</td>
</tr>
<tr>
<td>11</td>
<td>3.532</td>
<td>0.0181</td>
</tr>
<tr>
<td>12</td>
<td>0.728</td>
<td>0.5413</td>
</tr>
<tr>
<td>13</td>
<td>1.739</td>
<td>0.1635</td>
</tr>
<tr>
<td>14</td>
<td>1.086</td>
<td>0.3601</td>
</tr>
<tr>
<td>15</td>
<td>1.983</td>
<td>0.1212</td>
</tr>
<tr>
<td>16</td>
<td>2.606</td>
<td>0.0561</td>
</tr>
<tr>
<td>17</td>
<td>1.379</td>
<td>0.2540</td>
</tr>
<tr>
<td>18</td>
<td>1.520</td>
<td>0.2139</td>
</tr>
<tr>
<td>19</td>
<td>1.640</td>
<td>0.1847</td>
</tr>
<tr>
<td>20</td>
<td>3.376</td>
<td>0.0219</td>
</tr>
<tr>
<td>21</td>
<td>0.975</td>
<td>0.4100</td>
</tr>
<tr>
<td>22</td>
<td>1.313</td>
<td>0.2748</td>
</tr>
<tr>
<td>23</td>
<td>0.449</td>
<td>0.7223</td>
</tr>
<tr>
<td>24</td>
<td>2.221</td>
<td>0.0902</td>
</tr>
<tr>
<td>25</td>
<td>2.959</td>
<td>0.0364</td>
</tr>
</tbody>
</table>
From this table, one variable at a time was entered based on the amount of variance accounted for by the variable (2). Variables are entered in decreasing order or from highest accountability of variance to lowest. Table XII is a summary of the thirteen variables that account for the majority of the variance in discriminating among the forty items by treatment group. These thirteen variables are listed in the order of highest accountability of variance with question forty accounting for the greatest degree of variance, question eleven the next greatest amount of variance among the forty items by treatment group, and so on.
Table XII shows these items are significant in terms of the F statistic. The Prob > F is the associated probability level after the selected variable has been entered. Variables forty, eleven, six, ten, thirty-seven, sixteen, twenty-eight, and one are significant to the .05 level.

### Significance of Treatment Groups

The four general story categories of basketball, football, hockey, and weather were analyzed in relation to the subject's treatment group and the subject's total correct responses on the KCLI and the RAI. The KCLI was divided into five listening scores. For basketball, there was a significant association...
between the basketball score and the subject's treatment group, as well as the interpretation inventory of the KCLI. Duncan's Multiple Range Test for the variable basketball scores produced the results in Table XIII.

**TABLE XIII**

**DUNCAN'S MULTIPLE RANGE TEST FOR BASKETBALL SCORES**

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>7.2273</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>4.7727</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>4.5909</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>4.5455</td>
</tr>
</tbody>
</table>

Table XIII shows that treatment group one, audio-video, is significantly different in terms of the mean from the other three treatment groups. Treatment groups one, two, and three (all between-channel forms of redundancy) had higher means based on the basketball items than treatment group four (within-channel redundancy). However, there was insignificant difference between treatment groups two, three, and four. For football, there was a significant relationship between the scores on the football items and the subject's treatment group, and between the football scores and lecture listening. Results are shown in Table XIV.
Table XIV shows that the mean of treatment group one is significantly different from the means of treatment groups two, three, and four. Again, treatment groups one, two, and three had higher means than group four. But there was insignificant difference between treatment groups two, three, and four. In hockey, there was a significant relationship between the scores on the hockey questions and the subject's treatment group and distraction listening. Table XV shows the results.

Table XIV

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>7.9545</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>5.4545</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>5.4545</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>4.6818</td>
</tr>
</tbody>
</table>

DUNCAN'S MULTIPLE RANGE TEST FOR FOOTBALL SCORES

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>6.5000</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>4.5909</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>4.4091</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>4.1818</td>
</tr>
</tbody>
</table>

DUNCAN'S MULTIPLE RANGE TEST FOR HOCKEY SCORES
between the scores and treatment group, short-term listening with rehearsal, interpretation, and receiver apprehension score. Table XVI shows the results of Duncan's test.

**TABLE XVI**

DUNCAN'S MULTIPLE RANGE TEST FOR WEATHER SCORES

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>8.5909</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>6.9091</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>6.6818</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>6.6364</td>
</tr>
</tbody>
</table>

Finally, all forty story items were analyzed. There was significant association between the total scores and the subject's treatment group and lecture listening inventory. Table XVII summarizes the results of Duncan's test.

**TABLE XVII**

DUNCAN'S MULTIPLE RANGE TEST FOR TOTAL ITEMS SCORES

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>30.273</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>21.727</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>21.136</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>20.045</td>
</tr>
</tbody>
</table>

The hockey, weather, and total item scores all show that treatment group one's mean is significantly different from the means of the
The hockey, weather, and total item scores show that treatment group one's mean is significantly different from the means of the other three treatment groups. Also, as with basketball and football, treatment groups one, two, and three had higher means than group four for hockey, weather, and total item scores. There was an insignificant difference among treatment groups two, three, and four.

Analysis of Covariance

The thirteen items found to account for the most variance were examined using analysis of covariance. The remaining twenty-seven items were discarded. The results for the Duncan Multiple Range Test for the thirteen items (corrected scores) were compared to the forty items to determine if the rankings of the treatment groups were affected. Table XVIII shows a significant association between corrected basketball scores and treatment group.

| TABLE XVIII |
| DUNCAN'S MULTIPLE RANGE TEST FOR CORRECTED BASKETBALL SCORES |

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>3.0000</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>2.2273</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>2.0909</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>2.0455</td>
</tr>
</tbody>
</table>
Again, there is a significant difference between the mean of group one and the other three groups. But with the corrected scores, group four (within-channel redundancy) ranked higher than group three (between-channel redundancy/audio-caption), though insignificantly. For football, a significant relationship was found between corrected scores and treatment group, and between corrected scores and lecture listening. Table XIX summarizes the results of the Duncan test on the corrected football scores.

**TABLE XIX**

**DUNCAN'S MULTIPLE RANGE TEST FOR CORRECTED FOOTBALL SCORES**

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>4.0455</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>3.0455</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>2.8182</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>2.2727</td>
</tr>
</tbody>
</table>

Football, as with basketball, shows a significant association with treatment group one. But this time with the corrected football scores the mean of group three is higher than treatment group two and four, though the difference is insignificant. Hockey's corrected scores showed a significant association between
the scores and treatment group and lecture listening. Table XX shows the results of the Duncan test.

**TABLE XX**

DUNCAN'S MULTIPLE RANGE TEST FOR CORRECTED HOCKEY SCORES

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>1.4091</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>0.9545</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>0.8636</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>0.8182</td>
</tr>
</tbody>
</table>

The corrected hockey scores produced the same ordering of the treatment groups as did the corrected football scores. Treatment group one was the only one significantly different from the other groups, and treatment group three outranked groups two and four. The last story category, weather, produced a significant association between the corrected scores and treatment group and short-term listening with rehearsal. Table XXI summarizes the results of the Duncan test. Table XXI shows treatment group one is again significantly different from the other three treatment groups in terms of immediate recall of information. This time the within-channel form of redundancy, group four, was ranked second according to the mean.
Groups two and three, both forms of between-channel redundancy were below group four. However, groups two, three, and four were not significantly different from each other in terms of immediate recall of information. The final dependent variable analyzed was the total corrected scores for all story categories. A significant relationship was produced between the total corrected scores and treatment group, as well as short-term listening with rehearsal and lecture listening. Table XXII shows the findings.

**TABLE XXII**

**DUNCAN'S MULTIPLE RANGE TEST FOR CORRECTED TOTAL ITEM SCORES**

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>14.136</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>10.409</td>
</tr>
<tr>
<td>2</td>
<td>22</td>
<td>10.364</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>9.682</td>
</tr>
</tbody>
</table>
Table XXII separates the treatment groups into two divisions. Group one is significantly different from the remaining three groups. In the second division is groups two, three, and four. Using all corrected scores, treatment group three outranks two and four. Although the difference between groups three and two is very small. Analysis of covariance by treatment groups using receiver apprehension scores was also executed. There were no significant results. In addition, there was no significant difference between groups based on the results of the Duncan Multiple Range Test.

Reliability Estimates

Using the original forty items that appeared on the multiple-choice examination, the Kuder-Richardson alpha reliability estimates were executed. Table XXIII summarizes the alpha reliability estimates for uncorrected item scores.

<table>
<thead>
<tr>
<th>Story Category</th>
<th>Reliability Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball</td>
<td>.81</td>
</tr>
<tr>
<td>Football</td>
<td>.84</td>
</tr>
<tr>
<td>Hockey</td>
<td>.69</td>
</tr>
<tr>
<td>Weather</td>
<td>.79</td>
</tr>
<tr>
<td>Total Items</td>
<td>.79</td>
</tr>
</tbody>
</table>
All five of the reliability estimates were acceptable estimates. Reliability was higher on the basketball, football, and weather questions than on hockey. Possible explanations are that hockey is not as popular a sport in the United States as the other two sports, and the contents of the hockey story were primarily hockey scores from the previous night’s games. Therefore, some subjects may have had a difficult time remembering names of teams and actual scores of games. The alpha reliability estimate for the total items was closer to the estimates of basketball, football, and weather.

Analysis of Data

The KCLI and the RAI were administered to all eighty-eight subjects before being randomly assigned to the four treatment groups. In the treatment groups, all subjects were exposed to the same message, but the channel of presentation varied between treatment groups. The same forty item multiple-choice examination was administered to all subjects after being exposed to the message. From the presentation of data there was no association between treatment group, score on the forty item test, or the receiver apprehension inventory. There was also no pattern of association between the treatment group, score on the forty item test, and the five parts of the KCLI.

But a closer examination of the test scores, means, and treatment groups does illustrate that treatment group one,
audio-video, did produce a significant difference from the other three treatment groups. Treatment group three, audio-caption, scored a little higher than treatment group two, audio-video-caption. This result was expected because group two required that one channel, sight, use two sources of information, the visual picture and the caption. Subjects in group two watched the picture and read the caption simultaneously while listening to the redundant audio. Overall, between-channel redundancy did produce higher means and higher test scores than did within-channel redundancy, all other factors being equal.

In this study, the major purpose was accomplished in that between-channel redundancy of a message, whether it be audio-visual, audio-visual-caption, or audio-caption, did produce higher scores than did within-channel redundancy, video-caption. And audio-video did produce means that were significantly different from the other three treatment groups. The secondary purpose was also achieved. The three forms of redundancy examined individually outranked within-channel redundancy.
CHAPTER BIBLIOGRAPHY


CHAPTER V

SUMMARY, FINDINGS, CONCLUSION, AND RECOMMENDATIONS

Summary

This study was designed to investigate the relationship between within-channel redundancy and recall of information and between-channel redundancy and recall of information. A secondary purpose was to compare three forms of between-channel redundancy: audio-video, audio-video-caption, and audio-caption with one form of within-channel redundancy: video and caption. These comparisons were designed to investigate which form of redundancy had a higher association with recall of information.

The study used eighty-eight undergraduate psychology and communication majors at a four-year state university. The subjects were randomly divided into four treatment groups to correspond with the four forms of redundancy under investigation. Each group consisted of twenty-two subjects.

The two major areas of interest in this study concerned the audio and visual segments of a televised news program and the presence and absence of interdependency between the audio and visual channels. Thus it was important to test the listening skills of all subjects. This was accomplished through the administration of the Kentucky Comprehensive Listening Inventory.
The test involved four exercises and produced five listening subscales or measures: short-term listening, short-term listening with rehearsal, interpretation, lecture, and distraction. The Receiver Apprehension Inventory was administered to the subjects to serve as an indicator of any subjects who experienced significantly high apprehension as receivers of information. All eighty-eight subjects were given the Kentucky Comprehensive Listening Inventory and the Receiver Apprehension Inventory.

Upon completion of the inventories, the subjects were randomly divided into treatment groups and shown an eight minute edited newscast. All four groups were presented the same instructional message, but the mode of presentation differed depending upon the treatment group. After viewing the instructional program each member of each group was given a forty item multiple-choice retention inventory based on the information presented in the newscast. The audio-visual program contained four stories: basketball, football, hockey, and weather, and ten questions were developed for each story.

The data were presented in terms of correct responses on the Kentucky Comprehensive Listening Inventory and the forty item retention inventory. Discriminate analysis was used to determine which items from the multiple-choice retention inventory accounted for the most variance. Thirteen items were found to account for the greatest amount of variance. Then data were presented using these thirteen items in an analysis of covariance. These
results showed that for all four story categories and total item scores that Group I, audio and video, was significantly different from the other three treatment groups.

Findings

The following findings appeared warranted as a result of this study.

1. The research question of the relationship between immediate recall and within-channel redundancy (video and caption) showed that there was no significant association between recall and within-channel redundancy. The data indicated that the means for Group IV were not significantly different from the other three treatment groups.

2. The research question of the relationship between immediate recall and between-channel redundancy in the delivery form of audio and video showed that there was a significant association between recall and Group I. The data indicated that the means for Group I, corrected and uncorrected, were significantly different from the other three treatment groups.

3. The research question of the relationship between immediate recall and between-channel redundancy in the delivery form of audio, video, and caption showed there was not a significant association between recall and Group II. The means for audio, video, and caption delivery system were not significantly different from the other delivery systems.
4. The research question of the relationship between immediate recall and between-channel redundancy in the delivery form of audio and caption showed that there was no significant association between recall and Group III. The means for Group III were not significantly different from Groups II and IV.

5. The research question of the relationship between immediate recall and between-channel redundancy collapsing across the three delivery systems showed a significant association between recall and between-channel redundancy. This relationship was significant in terms of the means of the three between-channel redundancy treatment groups.

6. The research question of the relationship between immediate recall and within-channel redundancy and immediate recall and between-channel redundancy showed that there was no significant association between immediate recall and within-channel redundancy. But there was a significant association between immediate recall and between-channel redundancy based on the means of the four treatment groups after the administration of the retention inventory.

Conclusion

The following conclusion appeared warranted as a result of this study.
1. The conclusion that instructors should use audio-visual materials in classroom instruction is not warranted by this study without controlling for between-channel redundancy of the audio-visual message.

Recommendations

The results of this study suggest the following directions for further research.

1. More research is needed in the area of content, structure, and production techniques of audio-visual instructional programs.

2. Additional studies are needed in the area of between-channel redundancy and the determination of an optimal redundancy rate.

3. Research is needed on how to incorporate between-channel redundancy into instructional programs to maximize recall of information.

4. Research is needed to develop techniques for measuring between-channel redundancy and to categorize it.
APPENDIX A

CHARACTERISTICS OF THE LISTENING TEST

The Kentucky Comprehensive Listening Inventory measures five different factors of listening in its subscales. Part One measures strictly short-term listening, Part Two measures listening with rehearsal (items which are to be recalled after some intervening time period of less than one minute—from fifteen to fifty seconds). Part Three measures the dimension of interpretation or understanding of personal relationships which form such an important portion of our day-to-day listening tasks.

Lecture listening is measured in Part Four. And Part Five is assessed by scoring specific parts of Part One and Part Two. The last six items in each of these parts contain some interfering material which measures the student's ability to concentrate on one stimulus. This portion can be scored separately to form a "Distraction" scale.

In summary, the KCLI consists of forty-eight items divided into twelve items on Short-term Listening, twelve on Short-term Listening with Rehearsal, ten on interpretation of the dialogue's meaning and the relationship of the people involved, and fourteen over the lecture, and twelve items called distractions. The tests are scored in terms of the number of correct items per section.

The Kentucky Listening Research Center, 1983
APPENDIX B

RECEIVER APPREHENSION INVENTORY

How do you rate the following statements?  SA = strongly agree;  A = agree;  N = no opinion;  D = disagree;  and SD = strongly disagree

SA  A  N  D  SD

1. I feel comfortable when listening to others on the phone.  5  4  3  2  1
2. It is often difficult for me to concentrate on what others are saying.  5  4  3  2  1
3. When listening to members of the opposite sex I find it easy to concentrate on what is being said.  5  4  3  2  1
4. I have no fear of being a listener as a member of an audience.  5  4  3  2  1
5. I feel relaxed when listening to new ideas.  5  4  3  2  1
6. I would rather not have to listen to other people at all.  5  4  3  2  1
7. I am generally overexcited and rattled when others are speaking to me.  5  4  3  2  1
8. I often feel uncomfortable when listening to others.  5  4  3  2  1
9. My thoughts become confused and jumbled when reading important information.

10. I often have difficulty concentrating on what others are saying.

11. Receiving new information makes me feel nervous.

12. Watching television makes me nervous.

13. When on a date I find myself tense and self-conscious when listening to my date.

14. I enjoy being a good listener.

15. I generally find it easy to concentrate on what is being said.

16. I seek out the opportunity to listen to new ideas.

17. I have difficulty concentrating on instructions others give me.

18. It is hard to listen or concentrate on what other people are saying unless I know them well.

19. I feel tense when listening as a member of a social gathering.

20. Television programs that attempt to change my mind about something make me nervous.
APPENDIX C

FORTY ITEM RETENTION INVENTORY

1. Vancouver defeated:
   a. Montreal
   b. New Jersey
   c. Quebec
   d. St. Louis
   e. New York

2. Dallas defeated:
   a. Cleveland
   b. Houston
   c. Washington
   d. Atlanta
   e. Seattle

3. Montreal stopped the:
   a. New Jersey Devils
   b. St. Louis Steamers
   c. Detroit Dealers
   d. Quebec Huskies
   e. Vancouver Canadians

4. The story immediately before the hockey scores was:
   a. Phoenix Suns
   b. basketball scores
   c. weather
   d. football scores
   e. top 10 college football teams

5. The Phoenix Suns defeated:
   a. Houston
   b. Dallas
   c. Portland
   d. Cleveland
   e. Utah

6. When the weatherman gave the current conditions, what appeared in the background?
   a. morning shot of downtown Phoenix
   b. the sunrise over Phoenix
   c. people jogging
   d. traffic on the freeway
   e. cows
7. St. Louis knocked off:
   a. New Jersey
   b. Minnesota
   c. Hartford
   d. Detroit
   e. New York

8. The Phoenix Suns' win was:
   a. the second in three outings
   b. the first in three tries
   c. only the fifth all season
   d. the first in two weeks
   e. the first all season

9. Arizona State:
   a. dropped one position in the polls
   b. was knocked out of the top 10
   c. climbed up in the polls
   d. stayed in the same position in the polls
   e. dropped two positions in the polls

10. The highest temperature in the nation was:
    a. 100 degrees
    b. 105 degrees
    c. 70 degrees
    d. 92 degrees
    e. 110 degrees

11. The number six team in the polls is:
    a. Arizona State
    b. Arkansas
    c. Georgia
    d. Penn State
    e. Nebraska

12. Pittsburgh defeated the New York Islanders by the score of:
    a. 7 - 6
    b. 3 - 1
    c. 5 - 2
    d. 5 - 4
    e. 3 - 2

13. The Phoenix Suns' next game is against:
    a. Utah
    b. Washington
    c. Houston
    d. Dallas
    e. Portland
14. The number ten team in the football polls is:
   a. Pittsburgh
   2. Penn State
   3. Alabama
   4. Washington
   5. Arizona State

15. The hottest spot in the nation was:
   a. San Diego, California
   b. Phoenix, Arizona
   c. Tucson, Arizona
   d. El Paso, Texas
   e. Alice, Texas

16. The last sport covered in the newscast was:
   a. tennis
   b. football
   c. basketball
   d. hockey
   e. baseball

17. Traveler’s advisories were posted in:
   a. Wyoming
   b. North Dakota
   c. Texas
   d. Minnesota
   e. Illinois

18. Minnesota outskated:
   a. Vancouver 6 - 4
   b. Quebec 5 - 2
   c. Hartford 7 - 6
   d. New York 3 - 1
   e. Montreal 5 - 4

19. The low for today is predicted to be around:
   a. 32 degrees
   b. 60 degrees
   c. 70 degrees
   d. 49 degrees
   e. 28 degrees

20. UPI is a:
   a. coaches' poll
   b. coaches and writers' poll
   c. writers' poll
   d. sportscasters' poll
   e. professional coaches and writers' poll
21. Most of the state of Arizona was experiencing:
   a. thunderstorms
   b. hail
   c. high winds
   d. snow
   e. drought

22. Arizona State went from number seven in the polls to number:
   a. three
   b. four
   c. five
   d. six
   e. eight

23. The high is predicted to be around:
   a. 65 degrees
   b. 60 degrees
   c. 79 degrees
   d. 85 degrees
   e. 70 degrees

24. The reason Arizona State is ranked in only one poll is because:
   a. the other poll did not believe Arizona State played well enough to be in the top 10
   b. Arizona State did not receive enough votes
   c. Arizona State lost their game last week
   d. Arizona State tied Arizona in their game last week
   e. Arizona State is on probation

25. The coldest spot in the nation was in:
   a. Hibbing, Minnesota
   b. St. Paul, Minnesota
   c. Boise, Idaho
   d. Rapid City, South Dakota
   e. Newcastle, Wyoming

26. The score of the Montreal game was:
   a. 5 - 4
   b. 5 - 1
   c. 6 - 4
   d. 8 - 2
   e. 9 - 4
27. The most outstanding player for the Phoenix Suns had six blocked shots. His name was:
   a. Larry Nance
   b. Moe Lucas
   c. Walter Davis
   d. Larry Bird
   e. Danny Ainge

28. The number two team in the football poll is:
   a. Georgia
   b. Nebraska
   c. UCLA
   d. Southern Methodist
   e. Alabama

29. At one point the Phoenix Suns were:
   a. ahead by three points
   b. down by 21 points
   c. ahead by 30 points
   d. down by one point
   e. ahead by 21 points

30. The big news in sports concerned:
   a. Arizona
   b. Arizona State
   c. UCLA
   d. Baylor
   e. Alabama

31. The forecast called for:
   a. rain
   b. sunshine
   c. snow
   d. sleet
   e. hail

32. The final score of the Phoenix Suns' game was:
   a. 92 - 80
   b. 87 - 84
   c. 95 - 90
   d. 87 - 85
   e. 92 - 87

33. The Phoenix Suns played:
   a. sloppy basketball
   b. average basketball
   c. excellent basketball
   d. their worst game of the season
   e. their best game of the season
34. Atlanta beat the:
   a. Dallas Mavericks
   b. Cleveland Cavaliers
   c. Phoenix Suns
   d. Washington Bullets
   e. New Jersey Nets

35. There was six inches of snow reported in:
   a. St. Louis, Missouri
   b. Glorieta, New Mexico
   c. Flagstaff, Arizona
   d. St. Paul, Minnesota
   e. Santa Fe, New Mexico

36. The score for the St. Louis hockey game was:
   a. 7 – 6
   b. 3 – 1
   c. not given in the sportscast
   d. 5 – 2
   e. 5 – 4

37. The number one team in the football poll is:
   a. Pittsburgh
   b. Southern Methodist
   c. Alabama
   d. Penn State
   e. Arizona State

38. The player responsible for bringing the Phoenix Suns back into the lead was:
   a. Magic Johnson
   b. Walter Davis
   c. Larry Nance
   d. Elvin Hayes
   e. Moe Lucas

39. The hockey scores were from games played:
   a. Sunday night
   b. last night
   c. Sunday afternoon
   d. Saturday night
   e. Friday night

40. Arizona State appeared in what poll?
   a. UPI
   b. Coaches' Poll
   c. Arizona State Coaches' Poll
   d. Western Coaches' Poll
   e. Associated Press
APPENDIX D

EDITING PROCEDURES OF THE VIDEOTAPE

Step I: A sixty minute television morning newscast that aired in November, 1982 was used as the source of the news stories.

Step II: Four stories were chosen from the total stories covered on the newscast. These stories were chosen because of the redundant nature of the audio and video. The stories included basketball, football, hockey, and weather.

Step III: These four stories were edited together using a computerized editor. The master tape was the original videotape that the show was taped on during the live delivery of the news in November, 1982.

Step IV: The captioning that was used for the newscasts shown to Groups II, III, and IV was added to the edited newscast by means of a computerized character generator. The captioning was placed at the bottom of the screen and was done in white. The captioning was verbatim what the reporter said during the story.

Step V: All four versions of the same newscast were edited onto the same three-quarter inch tape from the original videotape. They were placed in order of treatment group.
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