EFFECT OF SPEED OF PRESENTATION AND IRRELEVANT CUES ON RECALL OF TELEVISION MESSAGES

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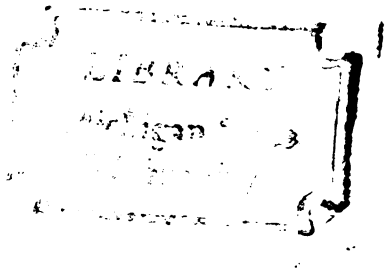

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ABSTRACT

EFFECT OF SPEED OF PRESENTATION AND IRRELEVANT CUES ON RECALL OF TELEVISION MESSAGES

by Robert W. Schlater

The Problem

Interference in the video channel of television messages and its relationship to recall of message information was the problem studied in two experiments. Two video channel variables were isolated for investigation. The thesis was that television production base lines must be established to facilitate scientific investigations of television production techniques. The findings from research of production variables should assist in predicting those techniques which will product strong message effects on television viewers.

Design

Experiment I studied speed of visual presentation. Speed was varied in five treatments and ranged from one visual per 30 seconds to nine visuals per 30 seconds. Experiment II investigated the ratio of irrelevant to relevant visual stimuli. Irrelevant stimuli were varied in six message treatments. The ratio of irrelevant visual cues to relevant visual cues ranged from 0:5 to 5:5.

Audio was held constant for all treatments in both experiments. The identical sound track consisted of audio information which was related but was not redundant with the visual information.

The criterion variable for both experiments was recall of visual information. Recall was tested by two types of multiple choice questions. Pictorial video questions utilized pictorial sketches of visual information. Verbal video questions were verbal descriptions of visual information.

Visual and audio stimuli were recorded on videotape and transmitted by closed-circuit television to 910 subjects who viewed the messages on television receivers in 30 different classrooms. Subjects were randomly assigned to classrooms, groups, treatments, and experiments. High school students attending a 4-H summer conference at Michigan State University constituted the experimental population.

Analysis of variance was used to test the significance of differences among group means of recall scores.

Findings

1. Interference, introduced by increasing the speed of video presentation, produced a significant difference ($p < .05$) when recall of visual information was tested using verbal video questions. No significant interference resulted when the relationship of speed and recall was tested using pictorial video questions. Speed of visual presentation had no significant effect on comprehension of information presented in the audio channel.

2. Increasing the ratio of irrelevant to relevant visual stimuli produced a significant difference ($p < .05$) on recall of audio information. The random pattern of the recall scores, however, precluded a meaningful interpretation. No significant effect was produced on recall of visual information measured with either pictorial video or verbal video questions when the ratio of irrelevant to relevant visual stimuli was increased.

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By

Robert W. Schlater

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The encouragement and assistance of the members of the author's doctoral committee are gratefully acknowledged. Professors Walter B. Emery, Randall P. Harrison, Colby Lewis, Leo A. Martin, James B. McKee, and Verling C. Troldahl each made a special contribution.

Special thanks are due Drs. Harrison and Lewis for the time they spent viewing the experimental television messages. Their criticisms and suggestions contributed significantly to the message quality attained.

The skill in research design and methodology exhibited by Dr. Troldahl who directed the study is impressive. To him, a sincere "thank you" for finding the time in a very busy schedule to make the valuable suggestions which brought this study to completion.

Finally, to my wife and son: that stranger in the house is your husband and father.

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CHAPTER I

INTRODUCTION

A goal of multiple channel communicators is to obtain predictably strong message effects on receivers through controlling the audio and visual aspects of the message. The development of techniques for achieving this goal is especially crucial to educators who are employing multiple channel media--television and film--in the teaching-learning process.

Of the two media, television has gained wide acceptance in the field of education in a comparatively short time. The Federal Communications Commission reserved channels for educational television purposes in 1952. By 1964, nearly 37 million enrollments in educational television classes were reported. Media and education experts predict that increasing numbers of students will receive instruction by television in the years ahead.[1]

Television possesses qualities which makes it a valuable medium in the educational process. These include the capabilities of

1. transmitting both verbal and visual symbols

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[1]Lawrence E. McKune, National Compendium of Televised Education (East Lansing: Michigan State University, 1965).

2. attracting and focusing attention

3. rapidly disseminating information to large numbers of receivers at one time.

When employed by educators, television is usually referred to as Instructional Television or ITV. The television message may be transmitted to receivers in classrooms by closed-circuit cable or by general broadcast. The message is usually subject matter designed for either direct or supplemental teaching.

Although instructional television is widely used at all educational levels, research supported techniques for producing strong message effects are notably lacking. Research in the past fifteen years has consisted largely of duplications of studies demonstrating that television teaching is generally as effective as classroom teaching.

Instructional television differs from many other communication situations in at least two ways:

1. The receivers are usually a captive audience and are probably more highly motivated to focus on the message than are typical television viewers.[2] The ITV receiver probably attends because of the knowledge that he will be tested over the information in the message. The arrangement of the viewing room and the presence of a classroom teacher or proctor also contribute to the focusing or attention "set."

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[2]J. E. Klapper, "The Comparative Effects of the Various Media," The Process and Effects of Mass Communication, ed. W. Schramm (Urbana, Illinois: University of Illinois Press, 1954), pp. 92-93.

2. The television director plays a prominent role in the composition of the ITV message. The instructor controls the content but the TV director is highly involved in its treatment, sometimes without the instructor realizing it. The director controls many of the stimuli contained in the message through his control of the television cameras and related equipment. He makes the over-all critical decision as to which of the available visual elements will be allowed in the field of view presented the receiver at a given time. He is usually the primary decision maker regarding the setting in which the television instructor will appear.

The source of the instructional television message may be said to be, in reality, a source-pair. In many instances, there is little correspondence between the instructor and the director. Each attends to his own specialty. This unawareness of each other's functions and each other's contributions to the television message may lead to interference in the transmitted message.

The fact that television provides two communication channels--video and audio--can also lead to problems. Multiple channel communication interference is predicted when (1) the information in the various channels is unrelated, (2) the cognitive difficulty or rate of presentation is such that successful alternation of attention among channels is not possible, (3) contradictory cognitive relationships exist among information units in the various channels.[3]

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[3]Frank R. Hartman, "A Review of Research on Learning from Single and Multiple Channel Communications and a Proposed Model with Generalizations and Implications for Television Communication," Research on the Communication Process (University Park, Pennsylvania: Pennsylvania State University, 1960), pp. 6-27.

Evidence, primarily from educational film research, suggests that the audio and visual channels of films are often "overloaded" with information. As channels become "overloaded," the findings show that learning decreases.[4] The concept of channel "overloading" is undoubtedly derived from the generalizations cited previously which suggest that interference occurs when the information in the various channels is presented at a too rapid rate making alternation between channels difficult.

The need for further study of the interference concept has increased in the past decade with the increased use of television for both commercial and educational purposes. Because of the many similarities between film and television, the interference generalizations applied to educational film probably also apply to television. It is a generally accepted fact that television communicators, both commercial and educational, often fill the visual channel of television messages with as much information as possible in the expectation that the additional cues will result in additional information.

Little research is available regarding interference in the visual channel of television communication. Single

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[4]Charles F. Hoban, "The Usable Residue of Educational Film Research," New Teaching Aids for the American Classroom (Stanford, California: Institute for Communication Research, 1960), p. 107.

channel investigations have concentrated on the audio channels of sound motion pictures and radio. Audio research is somewhat easier to conduct because of the nature of the code. Verbal code is ordinarily utilized in these studies and, because of its sequential nature, measurements have been easier to obtain. Visual information does not require sequential presentation. A vast amount of information may be presented in one visual display.

One of the ultimate goals of research in the television medium is to discover knowledge about the two channels employed in television communication. Research findings can be used to assist in obtaining predictably strong message effects on receivers through control of the design of the message.

Since the component parts of television messages--the video and audio stimuli--are not known to be homogeneous by nature, quantification of the effects of the channels when used in combination is difficult to obtain with present measuring instruments. It was determined, therefore, that the research design of the study reported here would investigate the video and audio channels separately. Until more is known about the effects contributed by each of the channels, there is a possibility that little additional knowledge can be added to what is now known about the channels when they are used in combination.

Purpose of the Study

The primary purpose of the research reported in this paper was to investigate interference in the visual channel of television messages. Two main questions were studied:

1. What is the maximum rate at which relevant visual information could be transmitted before recall of visual information was impeded?

2. What is the maximum ratio of irrelevant to relevant visual information which could be transmitted before recall of the relevant visual information was impeded?

Because television messages normally employ both the video and audio channels, two secondary propositions were also investigated:

1. What is the maximum rate at which relevant visual information could be transmitted before recall of the audio information in the television message was impeded?

2. What is the maximum ratio of irrelevant to relevant visual information which could be transmitted before recall of the audio information in the television message was impeded?

Although television is a widely employed medium, research directly applicable to the propositions cited above is scarce.

A recent (1964) review of research and theory relating to audiovisual information transmission by Travers, et al., points out serious flaws in studies which have investigated the transmission of redundant information through two sensory channels. The absence of any test of significance

is the most serious error reported and runs through an entire series of studies beginning with one by Munsterberg and Bigham in 1894.[5]

Some of the studies were replicated by Travers and his associates. They introduced proper controls in the research designs in treatments which included audio, visual, and audiovisual channels of communication. The replications failed to demonstrate any particular advantage for transmitting redundant information through more than one sensory channel, which the earlier studies purportedly showed.[6]

In the visual "rate" and "ratio" investigations reported in this paper, information in the video and audio channels were related but were, by design, not completely redundant. The experiment was not designed to check the relationship between the two channels. The audio portion of the message was kept the same for all experimental versions of the message. The "rate" and "ratio" manipulations in the video channel were expected to influence recall of information presented in the video channel and recall of information presented in the audio channel.

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[5]Robert M. W. Travers (editor and principal investigator), Research and Theory Related to Audiovisual Information Transmission (Salt Lake City, Utah: University of Utah Bureau of Educational Research, 1964), pp. 6.17-6.26.

[6]Ibid.

Research Review

Rate of Information Transmission

Available related research will be reported separately for each of the two main propositions reported in this study.

Proposition 1 investigated the rate of transmission of visual information in television messages. Two educational film studies are pertinent and have been analyzed by Miller, et al.

> Rate of development is not, of course, a simple, unitary variable; rather it is a term that comprehends a number of more specific factors such as rate of speaking, amount of pausing for emphasis or observation, amount of oral or visual redundancy, and repetition within a film. "Rate of development" treated as an undefined composite has been shown by Jaspen (1950) to be related to the amount of learning from films demonstrating a mechanical assembly. Similarly, Kopstein, Sulzer, and Lumsdaine (1952) have demonstrated that intra-film repetition by use of added examples increased learning in films on micrometer reading. These investigations showed that the "point of diminishing returns" for adding of further instructional examples depended on difficulty of the material and intelligence of the learner, but that in any case there was value in giving more examples than often is done in the "once over lightly" type of training-film treatment.[7]

Further examination of the Jaspen study, cited by Miller, revealed the finding that film presentations

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[7]Neal E. Miller, et al., "Graphic Communication and the Crisis in Education," AV Communication Review, 5 (Winter, 1957), p. 96.

containing fewer shots were superior to presentations containing more shots in terms of information gain.[8]

Gropper, in a research proposal to investigate the difficulty level and tempo of instruction, held that

> an optimum rate of presentation for efficient learning is one that paces students so that they are able with high frequency to respond correctly in the presence of appropriate cues. A less than optimum rate is one that results in a high frequency of student errors in the presence of the same cues.[9]

Several television studies have investigated the overall area of presentation rate but in less specific terms than were present in the film studies. Schramm found in a review of 393 television studies that television messages may be "overloaded" with information. He implies that "complexity of presentation and a great variety of visual cues may distract a student from the main principles of the presentation."[10]

Holmes analyzed and correlated a number of television studies and found that students who received "simple" presentations showed greater achievement on information tests

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[8]Nathan Jaspen, Effects of Training of Experimental Film Variables: Study 1, Verbalization, Rate of Development, Nomenclature, Errors, "How it Works," Repetition (Technical Report SDC 269-7-17, Special Devices Center, Office of Naval Research, Port Washington, N. Y., 1950).

[9]George L. Gropper, "An Experimental Evaluation of Procedures for 'Individualizing' Televised Instruction," Television and Human Behavior, ed. Leon Arons and Mark A May (New YOrk: Appleton-Century-Crofts, 1963).

[10]Wilbur Schramm, "What We Know About Learning from Instructional Television," Educational Television the Next Ten Years (Stanford, California: The Institute for Communication Research, 1962), p. 66.

than did students who viewed "highly visualized" presentations. He defined "highly visualized" those presentations which made maximum use of the visual potential of the television medium. "Simple" presentations made minimum use of the visual potential.[11]

Carpenter and Greenhill found that lecture and blackboard alone made for more learning than lecture plus charts, plus models, plus training films, plus visiting speakers, plus dramatizations, and so forth in an Air Science class. A replication of the experiment in a psychology class resulted in no significant difference.[12]

At New York University, Klapper found "simple" television presentations produced greater learning than did "highly visualized" presentations in a course entitled "Man's Cultural Heritage."[13]

Rock, et al., found the least effective programs in terms of information gain were those in which considerable time was spent dramatizing the lesson material while the instructor who described the action was not shown. This

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[11]Presley D. Holmes, Jr., Television Research in the Teaching-Learning Process (Detroit, Michigan: Wayne State University, 1959).

[12]C. R. Carpenter and L. P. Greenhill, An Investigation of Closed Circuit Television for Teaching University Courses. Instructional Television Project Report Number 2 (University Park, Pennsylvania: Pennsylvania State University, 1958).

[13]Hope L. Klapper, Closed-Circuit Television as a Medium of Instruction at New York University (New York: New York University, 1958).

treatment was compared with one in which the instructor presented the material in a straightforward manner.[14]

Information theory, posited by Shannon and Weaver, acknowledges the identifiable variable of interference in the communication process. Weaver submits that "it seems highly suggestive for the problem at all levels that error and confusion arise and fidelity decreases, when, no matter how good the coding, one tries to crowd too much over a channel."[15]

One study which could be said to be contrary to the visual rate proposition was Aylward's finding that a dynamic style of editing a television program had a significant effect on information gain. In dynamic editing, there was a change of picture on an average of every thirty seconds. This was compared with a static style in which the picture was changed on the average of once every three minutes.[16]

Regardless of the identification term used in the studies cited above, it is apparent that all are concerned

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[14]R. T. Rock, Jr., J. S. Duva, and J. E. Murray, Training by Television: The Comparative Effectiveness of Instruction by Television, Television Recordings, and Conventional Classroom Procedures (Technical Report 476-02-2, Special Devices Center, Office of Naval Research, Port Washington, N. Y., 1951).

[15]Claude E. Shannon and Warren Weaver, The Mathematical Theory of Communication (Urbana, Illinois: University of Illinois Press, 1949).

[16]Thomas J. Aylward, Jr., "A Study of the Effect of Production Techniques on a Televised Lecture," Dissertation Abstracts, XXI (1961), pp. 1660-61.

in varying degrees with the rate of visual information variable which was one of the two core variables investigated in the research reported in this paper.

Only one of the studies defined rate of development of a television message as a unitary variable, manipulation of the rate of visual presentation, as was done in the research reported here. None of the studies cited above reported the optimum level of rate presentation. In this research, rate of visual presentation was treated so that the number of visuals presented per unit of time and their effect on recall of video and audio information could be discretely measured.

These factors support the thesis of the reported research that a base line must be developed for a variety of variables present in television messages. By establishing base lines, scientific research can be conducted whose findings, it is hoped, will help predict those production techniques which can be utilized to produce strong message effects on receivers.

Ratio of Irrelevant to Relevant Visual Information

Proposition 2 investigated ratio of irrelevant to relevant visual information in television messages. This variable is one about which both film and television production experts have developed "rules," primarily by intuition. Few studies exist which have subjected their rules to scientific testing.

McIntyre has pointed out the need for evaluating the appropriateness of visual stimuli.

> Questions about appropriateness of cues most often occur with reference to sets and other elements of design which will usually have some general relationship to the subject at hand. However, they may contribute little as stimuli pertaining to the instructional message with respect to the intended response of students. At best, they are frequently non-functional; at worst, they may conflict with other essential cues.[17]

Seibert concurs with McIntyre's position.

> On cue, or stimulus, in learning, it would appear that television's great strength is also a potential weakness. The stimulus field which television presents to students is immensely rich, yet within the richness, students must somehow be brought to recognize which features of any given scene are relevant to the intended learning. . . . Eventually, I suppose, students may learn to discount those parts of an elaborate set which never are central to the instructor's purpose, yet there would be some wisdom in presenting visual scenes which have few distracting or irrelevant cues within them and, thus, that leave the student unencumbered by futile searches or frequent visual excursions.[18]

Deutschmann, et al., investigated relevant and irrelevant information learned in different communication situations. They compared teaching in a classroom or laboratory with teaching by film or television. They assumed that film or TV would provide proportionately more focusing upon relevant information and less focusing on irrelevant items than would be the situation in a

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[17]Charles J. McIntyre, "Applying Learning Theory to Televised Instruction," NAEB Journal, Vol. 24, No. 6 (1965), p. 59.

[18]Warren F. Seibert, "Comments," NAEB Journal, Vol. 24, No. 6 (1965), p. 66-67.

laboratory. The results of the study provided evidence for the hypothesized greater efficiency of mass media over non-mass communication media but did not support the hypothesized difference between film and television.[19]

Deutschmann and his associates tested for the decoding of both the relevancies and the irrelevancies in the verbal learning tests they administered. Ordinarily, the learning of irrelevancies are discovered post hoc when the hypothesized learning of relevant material failed to occur. In their research, the key dependent variable was the relationship between the measures of relevant and irrelevant information. The data showed considerable variation in the amount of relevant and irrelevant information learned under several testing conditions. The fact that they found learning of irrelevant information did occur supports the proposition investigated in the research reported in this paper.

Kumata tested a relevant-irrelevant hypothesis in an investigation of advertising students. His hypothesis stated that a face-to-face group which would see visual aids (advertisements) presented in color and enlarged upon a projection screen would remember a great deal of the detail of the ads compared with a TV group. The TV subjects would see the same ads in black and white on a twenty-five inch

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[19]Paul J. Deutschmann, Lionel C. Barrow, and Anita McMillan, "The Efficiency of Different Modes of Communication," AV Communication Review, Vol. 9 (November-December, 1961), pp. 263-70.

TV monitor. It was hypothesized that the TV group would remember the principles involved better than the face-to-face group on the basis that there were less distracting irrelevant cues for the TV group. The hypothesis was confirmed.[20]

Educational film studies have included findings of stimulus relevancy. Roshal found in a film that was produced to teach knot tying that the film in which the rope appeared to tie itself proved to be superior to a film in which a pair of hands tied the knot. One interpretation of this finding was that the hands were irrelevant cues and that they obscured the essential or relevant cues.[21]

Neu investigated the relevance of visuals in a film. He found that irrelevant additions appeared to lower potential learning. His study was based on the use of devices to direct attention to the relevant or critical information as contrasted to the irrelevant information.[22]

Visual presentations designed for concept learning can be presented with varying amounts of relevant and

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[20]Hideya Kumata, "Two Studies in Classroom Teaching by Television," The Impact of Educational Television, ed. W. Schramm (Urbana, Illinois: University of Illinois Press, 1960).

[21]S. M. Roshal, Effects of Learner Representations in Film-mediated Perceptual-Motor Learning (Technical Report SDC 269-7-5, Special Devices Center, Office of Naval Research, Port Washington, New York, 1949).

[22]D. M. Neu, Effect of Attention-Gaining Devices on Film Mediated Learning (Technical Report SDC 269-7-9, Special Devices Center, Office of Naval Research, Port Washington, N. Y. 1950).

irrelevant information. Hunt has summarized the evidence on irrelevant dimensions in concept learning citing a series of studies conducted by Bourne and his associates. These studies indicated that as the number of irrelevant dimensions increased, the number of errors in concept learning also increased.[23]

The visual presentations in Bourne's investigations consisted of geometric patterns which were varied in size, shape, color, and position in the display. He found that while an increase in the number of irrelevant dimensions, redundant or non-redundant, increased the number of errors, an increase in the number of non-redundant relevant dimensions also increased the errors.[24,25]

Travers analyzed the Bourne studies and held that the effect was apparently one in which the amount of information represented by the stimulus array was of utmost importance. According to Travers, "the addition of non-redundant dimensions, whether relevant or irrelevant,

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[23] E. B. Hunt, Concept Learning (New York: Wiley, 1962).

[24] L. E. Bourne and R. C. Haygood, "Supplementary Report: Effect of Redundant Relevant Information upon the Identification of Concepts," Journal of Experimental Psychology, Vol. 61 (1961), pp. 259-60.

[25] C. M. Walker and L. E. Bourne, "The Identification of Concepts as a Function of Amount of Relevant and Irrelevant Information," American Journal of Psychology, Vol. 74 (1961), pp. 410-17.

increases the amount of information which the subject must process in order to solve the task."[26]

Archer found that when relevant information was obvious the subject had an easier time learning the concept. (Obvious was defined as a stimulus with a high probability that the subject would respond to it.) When the irrelevant information was obvious the task was more difficult. A further finding was that when the relevant information was not obvious, it took significantly more time and errors to learn the concept, but when the irrelevant information was not obvious there was less of an inhibitory effect. The concept identification task in the Archer study used patterns which were varied in form and size.[27]

From the studies cited, it has been demonstrated that the variable of irrelevant stimuli can be identified and its effect measured. In a majority of the studies reported, the effect of irrelevant stimuli on learning was measured.

In the research reported later, the criterion variable was recall of relevant visual information in television messages for both propositions investigated. Testing for recall immediately after viewing the television messages was used so that the optimum transmission rate of visual information before recall was impeded could more precisely be determined.

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[26]Travers, op. cit., p. 4.11.

[27]E. J. Archer, "Concept Identification as a Function of Obviousness of Relevant and Irrelevant Information," Journal of Experimental Psychology, Vol. 63 (1962), pp. 616-20.

CHAPTER II

METHODOLOGY

General Research Design

The research reported in this paper was exploratory. Formal hypotheses were neither formulated nor tested. Two problems concerning interference in the visual channel of television messages constituted the research questions which were explored. The problems were operationalized as Experiment I and Experiment II.

Experiment I

This experiment investigated the maximum rate at which relevant visual information can be transmitted before recall of that information is impeded. Five different television message treatments were developed which varied in the number and duration of units of visual information.

The message treatments were produced utilizing the following operational definitions:

1. Rate is the number of discrete relevant visual stimulus exposures presented per unit of time.

2. A discrete exposure is the output of one TV camera at a given moment in time. A new exposure occurs when the output of a different camera is switched to.

3. Relevant stimuli are those stimuli, video and audio, in experimental television

messages which subjects must attend to and decode in order to answer correctly the questions posed in the testing instrument.

Experiment II

Investigated in this experiment was the maximum ratio of irrelevant to relevant visual information which can be transmitted before recall of the relevant visual information is impeded. Six different message treatments were developed which varied the number of irrelevant inclusions with relevant visual information.

The message treatments for Experiment II were based on the following operational definitions:

1. Ratio is the fraction derived from the number of irrelevant visual stimulus exposures as the numerator and the number of relevant visual stimulus exposures as the denominator.

2. Relevant stimuli are those video stimuli presented in experimental television messages which subjects must attend to and decode in order to answer correctly the questions posed in the testing instrument.

3. Irrelevant stimuli are those visual stimuli presented in experimental television messages which are unnecessary for subjects to attend to and decode in order to answer correctly the questions posed in the testing instrument.

Experimental Television Messages

Requirements for the experimental television messages were:

1. A topic whose content was unfamiliar to the experimental population.

2. A topic which could be developed into a television message which logically progressed from a beginning to an end. Stimulus materials such as nonsense syllables, foreign languages, or non-familiar symbols were avoided.

3. Relevant pictorial materials which were available and could be presented in discrete exposures.

4. Pictorial materials which adapted themselves to objective testing without a need for audio explanations.

The topic selected, from several considered, was Greek temple architecture. It was assumed that experimental subjects would have had little exposure to a detailed presentation of this subject. A variety of illustrated books were available in the Michigan State University library. The books, primarily British and German, were well documented with photographs of temple ruins.[28] Slides of Greek temples were also available from the Humanities Department at Michigan State University.

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[28]Illustrated books used:

Jean Charbonneaux, Aspects de la Grèce (Paris: Les Editions Braun & Cie, not dated); Sir Banister Fletcher, A History of Architecture on the Comparative Method (7th ed.; London: B. T. Batsford, Ltd., 1924); A. Trevor Hodge, The Woodwork of Greek Roofs (Cambridge: At the University Press, 1960); Hanns Holdt and Hugo von Hofmannsthal, Picturesque Greece (New York: Architectural Book Publishing Co., not dated); H. M. Schwarz, Sicily (London: Thames and Hudson, 1956); Paul Ortwin Rave, Griechische Tempel (University of Marburg, Germany, 1924); Gerhart Rodenwaldt, The Acropolis (Oxford: Basil Blackwell, 1957).

Several scripts were developed around the available photographs before the final selection was made (Appendix I). Nine major sub-topics which met the criteria listed above and supported the over-all topic of Greek temple architecture were:

1. Location of temples on hills
2. Floor plans of temples
3. Roof construction of temples
4. Capitals of Doric order columns
5. Capitals of Ionic order columns
6. Capitals of Corinthian order columns
7. Bases of Doric order columns
8. Bases of Ionic order columns
9. Bases of Corinthian order columns

Verbal information presented through the audio channel in the experimental television messages was held constant for all message treatments in both experiments. The verbal cues were non-redundant with the visual stimuli. They did consist, however, of statements which were related to the message sub-topics.

Three sentences, each approximately ten seconds in length, were read by a narrator for each of the nine sub-topics of the basic message. The narrator was a professional television performer who delivered the audio information at approximately 125 words per minute. Television

techniques for presenting verbal information were employed to include incomplete sentences, pauses, and verbal punctuation.

Experiment I Message Treatments

It was intuitively determined that the base line for Treatment 1 of Experiment I should be 1 visual per 30 seconds. From that base, the other 4 treatments were designed with progressively higher rates of visual presentation (Table 1).

The messages were 4.5 minutes long. To place the visuals in the context of a "typical" television presentation, it was decided that a narrator would introduce and close the experimental messages. A 30 second opening and a 30 second closing were developed during which the narrator appeared on the television screen. Total length of the experimental television messages was 5.5 minutes for all treatments.

The narrator was seated at a desk with a non-distracting drape in the background. A chest shot which did not show either his hands or the top of the desk was used in both the opening and closing. The camera was positioned and the pan and tilt heads locked. The camera did not move during either the opening or closing.

The experiment was designed so that the number of visuals shown per 30 seconds progressed by 2 for each of the 5 treatments. The opening and closing shot of

TABLE 1.--Experiment I visual requirements by treatment, number, rate, and duration.

Treatment Number	Number of Visuals per 30 seconds	Number of Message Sub-topics to be Visualized	Total Visuals in Treatment	Duration of Each Visual
1	1	9	9	30 seconds
2	3	9	27	10 seconds
3	5	9	45	6 seconds
4	7	9	63	4-1/4 seconds
5	9	9	81	3-1/3 seconds

the narrator were not varied and were not considered in rate calculations for the five message treatments.

From Table 1 it can be seen that 81 discrete relevant visuals were required for Experiment I. The 81 were needed for Treatment 5. For each other treatment, in reverse order from Treatment 5 to 1, 18 fewer visuals were required per treatment. A table of random numbers was employed to eliminate two visuals per sub-topic for the total of 18 visuals per treatment.

Visuals were photographed on 35 mm film and mounted in 2x2 inch slide holders. Visuals selected and photographed for each of the nine sub-topics were related to the sub-topic subject matter but were not completely redundant in pictorial composition. The nine photographs of Greek temple floor plans in Treatment 5, for example, were of nine different temples.

Treatments 1 and 2 were produced using the slide chain in the control room at Michigan State University's closed-circuit television studios. Because only 16 slides could be set in each of the two projectors, a different system was employed for Treatments 3, 4, and 5 which required from 45 to 81 slides.

In Treatments 3, 4, and 5 a Kodak carousel and a Bosch and Lomb slide projector were set up in a television studio. Two standard audio-visual projection screens were positioned to pick up the projected slides. Two Serkes Tarzian vidicon

studio television cameras were pre-set on each screen. Lenses were selected and the cameras placed to frame the slides which were of constant size. The pan and tilt heads of the cameras were then locked.

Slides were numbered and the even numbered slides set in one of the projectors and the odd numbered in the other projector. Projector operators in the studio changed slides with remote switches after the camera had been switched to the slide on the opposite projector.

Before Treatments 3, 4, and 5 were produced, it was necessary to conduct a trial experiment to discern possible differences between studio projection of slides on screens with pickup by cameras and the method used in Treatments 1 and 2 which had employed the slide chain in the control room. Closed-circuit television engineers and production personnel were satisfied that no differences existed in the quality of the videotaped visuals between the two systems.

Timing of Slide Changes

The television director was required to switch from camera to camera on a time signal in each of the five treatments. For Treatments 1 and 2, the videotape engineer cued the director at the end of 30 and 10 seconds, respectively, over the intercommunication system. The videotape engineer observed a time counter on the videotape recorder to determine lapse of time.

For Treatments 3, 4, and 5 the timing of the slide changes presented a more difficult problem because of the progressively faster switches required. The problem was compounded by the fact that in Treatments 4 and 5 the switch between slides was made at time intervals which included fractions of seconds. It was not possible to read the videotape time counter or a stop watch at this tolerance.

To solve the problem, a Stobotac machine, manufactured by the General Radio Company of Concord, Massachusetts, was borrowed from the Human Energy Laboratory of the Department of Health, Physical Education, and Recreation at Michigan State University. The machine flashes a light at desired intervals. The machine can be set at various revolutions per minute and the light will flash that exact number of times.

For Treatment 3 which required a slide change every 6 seconds, the machine was set at 120 rpm. The light flashed twice each second. By counting 12 light flashes, it was possible to get an exact 6 seconds timing. A portable audio tape recorder was used to prepare timing tapes for Treatments 3, 4, and 5. For Treatment 3, after the light had flashed 12 times, the word "take" was spoken into the audio tape recorder microphone. The spoken word "take" was recorded for approximately 8 minutes for each of the three timing tapes prepared.

For Treatment 4, 7 visuals were shown each 30 seconds or 1 visual every 4-1/4 seconds. The machine was set at

240 rpm which resulted in 4 light flashes per second. By counting 17 flashes and speaking the word "take," the timing tape for this treatment was prepared.

For Treatment 5, 9 visuals were shown each 30 seconds or 1 visual every 3-1/3 seconds. The machine was set at 180 rpm. The light flashed 3 times per second. By counting 10 flashes and speaking the word "take," the audiotape time cue for Treatment 5 was prepared.

A portable audio tape recorder was used in the control room by the director during the videotaping of each treatment. The recorder was set in the playback position and was placed on a chair next to the director. The appropriate timing tape was placed on the recorder and cued to the first spoken word "take" on that particular tape. When the director faded up slide for the videotaping of the slide segment, the audio recorder was turned on. The director then switched from camera to camera on the cue word "take" which he heard from the portable recorder.

Experiment II Message Treatments

Audio and relevant visual information employed in Experiment I were also used in Experiment II. Pre-test data showed achievement of a high level of recall of relevant visual information when the visual rate was approximate to Treatment 3 of Experiment I. Treatment 3 of Experiment I was selected as the rate of relevant visual presentation to be used in Experiment II.

Irrelevant information included with relevant visuals from Treatment 3 of Experiment I is shown in Table 2. Irrelevant inclusions increased from 1 irrelevant cue for each of the 9 sub-topics to 5 irrelevant cues for each of the 9 sub-topics in 5 treatments. Treatment 0 of Experiment II was the base line (Treatment 3 of Experiment I) which established the amount of recall occurring when no irrelevant cues had been added to the messages. Means of test scores of subjects in Treatment 3 of Experiment I were used for Treatment 0 of Experiment II.

It was determined that the irrelevant inclusions should be composed of television techniques that are "typical" of many television productions. The five selected were:

1. Superimposure. A black card with white block letters was prepared which, when superimposed over the relevant visual, appeared in the lower one-third of the television frame. The verbal information was, "Photos by Guggenheim Museum." The credit was fictitious.

2. Boom shadow. Two microphone booms were placed in the studio in such a way that a shadow appeared on the beaded screens. The shadow could be made to appear or disappear by panning the boom.

3. Ornate frames (goboes). The frames were prepared by an artist on two 11 x 14 inch gray television cards. The center of the cards was removed and ornate patterns were painted on the remainder of the card. The frames were attached to two studio hods which were placed approximately three feet in front of the television cameras. The frame appeared to surround the slide projected on the screen. A studio assistant moved the hods to positions marked with masking tape on the studio floor. When the

TABLE 2.--Experiment II visual requirements by treatment, number, ratio, and duration.

Treatment Number	Relevant Visuals		Irrelevant Inclusions	Irrelevant to Relevant Ratio
	Number	Duration (in sec)	Number	
0[a]	45	6	0	0:45
1	45	6	9	9:45
2	45	6	18	18:45
3	45	6	27	27:45
4	45	6	36	36:45
5	45	6	45	45:45

[a]Treatment 3 of Experiment I

frame was not included as an irrelevant cue, the hod was moved out of the angle of view of the television camera during the six seconds the alternate camera was on the air. When the frame was to be included, the hod was moved quickly to the position marked with masking tape.

4. Letters or numbers on slide. These irrelevant cues were placed on the slides with a grease pencil. The number or letter usually was printed in the upper left hand corner but in some instances in other locations on the slide because of density of the slide.

5. Shadow of a hand or finger pointing. This gesture was accomplished by studio assistants placing a hand or finger directly in front of the slide projector. By making a sweeping motion through the light beam of the projector, the shadow appeared on the screen. The gesture was general to the entire slide. Specific areas of the slide were not emphasized.

Irrelevant inclusions were designed to be used with the relevant visuals of specific sub-topics (Table 3).

To preclude a pattern or rhythm of irrelevant inclusions and a subsequent attention "set" by subjects, the irrelevant inclusions were inserted with the relevant visuals in a somewhat random method. In Table 4, the picture number is the relevant visual with which the irrelevancies were included.

Pre-testing

Three pre-test experimental television messages were produced and tested. The messages were designed to present visual information at rates intuitively determined to be low, medium, and high. Rate of presentation was manipulated as shown in Table 5.

TABLE 3.--Experiment II irrelevant inclusions by treatment and number.

Irrelevant Inclusion	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5
Superimposure of credit over temples on hills visuals	1	2	3	4	5
Boom shadow over floor plan visuals	1	2	3	4	5
Ornate frame over roof construction visuals	1	2	3	4	5
Letters or numbers over three orders of capitals visuals:					
Doric	1	2	3	4	5
Ionic	1	2	3	4	5
Corinthian	1	2	3	4	5
Gesture over three orders of bases visuals:					
Doric	1	2	3	4	5
Ionic	1	2	3	4	5
Corinthian	1	2	3	4	5
Total	9	18	27	36	45

TABLE 4.--Experiment II irrelevant inclusions by type, treatment, and relevant visual order.

Irrelevant Inclusion	Treatment Number				
	1	2	3	4	5
Superimposure	Pix 2	Pix 2,5	Pix 1,2,5	Pix 1,2,4,5	Pix 1,2,3,4,5
Boom Shadow	Pix 1	Pix 1,4	Pix 1,3,4	Pix 1,3,4,5	Pix 1,2,3,4,5
Ornate Frame	Pix 3	Pix 3,4	Pix 2,3,4	Pix 2,3,4,5	Pix 1,2,3,4,5
Letters or Numbers:					
Doric	Pix 1	Pix 1,3	Pix 1,3,4	Pix 1,2,3,4	Pix 1,2,3,4,5
Ionic	Pix 2	Pix 2,4	Pix 2,4,5	Pix 2,3,4,5	Pix 1,2,3,4,5
Corinthian	Pix 5	Pix 3,5	Pix 2,3,5	Pix 1,2,3,5	Pix 1,2,3,4,5
Gesture:					
Doric	Pix 1	Pix 1,4	Pix 1,2,4	Pix 1,2,4,5	Pix 1,2,3,4,5
Ionic	Pix 3	Pix 3,4	Pix 3,4,5	Pix 2,3,4,5	Pix 1,2,3,4,5
Corinthian	Pix 4	Pix 4,5	Pix 2,4,5	Pix 1,2,3,4	Pix 1,2,3,4,5

TABLE 5.--Pre-test messages by groups, duration, and ratio.

Groups	Visuals		Audio Sentences		Visual to Sentence Ratio
	Number	Duration (in sec)	Number	Duration (in sec)	(In 30 sec. units)
X	6	30	18	10	1:3
Y	18	10	18	10	3:3
Z	36	5	18	10	6:3

Three separate groups of subjects were pre-tested. The first group consisted of 77 college subjects from a junior level advertising class at Michigan State University. Significant results were not obtained. Subjects indicated they had received instruction in message content (Greek temple architecture) in a required sophomore level class in Humanities.

A freshman level speech course at Michigan State University was pre-tested next. The 51 subjects indicated in demographic questions that a majority were not freshmen and that they too had been exposed to the television message content in the required Humanities course. Results between treatments were not significant.

The third group pre-tested consisted of 62 subjects from a high school at Corunna, Michigan. A significant F was obtained in an analysis of variance statistical treatment on recall of visual information (Table 6). The analysis of variance on recall of audio information was not significant (Table 7).

It was decided that subjects for the two experiments must consist of high school students if the television message topic which had been developed for the pre-test was to be used. It was also decided to increase the range of speeds tested, particularly at the rapid presentation end of the range.

TABLE 6.--Analysis of variance of rate tested on video recall by high school pre-test subjects.

	One slide per 30 seconds	Three slides per 30 seconds	Five slides per 30 seconds
Group means	3.90	5.33	6.04

Source	df.	s.s	m.s.	F	p
Between groups	2	48.79	24.40	4.32	<.05
Within groups	59	333.42	5.65	--	--
Total	61	382.21	--	--	--

TABLE 7.--Analysis of variance of rate tested on audio recall by high school pre-test subjects.

	One slide per 30 seconds	Three slides per 30 seconds	Five slides per 30 seconds
Group means	3.50	3.76	4.00

Source	df.	s.s	m.s.	F	p
Between groups	2	50.18	25.09	1.79	n.s.
Within groups	59	825.45	13.99	--	--
Total	61	875.63	--	--	--

Sample of Subjects

A total of 910 high school students served as subjects for the two main experiments. Nine hundred eight usable test questionnaires were completed.

Subjects were in residence at Michigan State University from June 15 to June 18, 1966, attending an annual 4-H conference. They represented 74 of Michigan's 83 counties. In addition to those attending because of membership in the Michigan 4-H Youth Programs, 51 high school age students had received special invitations. Nineteen members of a Job Corps Training School at Hoxieville, Michigan, 30 students from downtown Detroit schools, and 2 students on an exchange from the state of Kentucky comprised this group.

Selection criteria to attend the conference were made at the local level. Conference leaders assume that long-time membership and interest in the 4-H programs were two primary considerations used for selection.

The 908 subjects who completed the questionnaires responded to demographic questions eliciting educational level, age, and sex (Table 8).

Subjects were randomly assigned to 30 classrooms upon arrival. Conference badges had been pre-numbered 1-30 and placed in 30 different piles. In the registration procedure, a 4-H leader presented his list of students to a conference official. He was handed badges, one from each of the piles, for the number of students he was registering.

TABLE 8.--Comparability of experimental and control groups on sex, age, and education.

Personal Characteristic	Experiment I	Experiment II	Control
Sex:			
Male	30%	30%	33%
	N=452	N=485	N=60
Age:			
14 years or less	10%	9%	8%
15 years	31	31	30
16 years	35	38	32
17 years	20	17	25
18 years and over	4	5	5
	100%	100%	100%
High School Education Level:			
Freshman	28%	21%	30%
Sophomore	37	41	27
Junior	26	27	33
Senior	9	11	10
	100%	100%	100%

The 4-H leader took the pre-numbered badges which provided a space for the student to write his name and passed them randomly to his group. Badges were assigned to subsequent leaders, one from each of the piles, until 30 students had been registered. Badges were then assigned from pile one through 30 throughout the remainder of the registration process. In each instance the leader randomly passed the badges to his group since only a number appeared on the badge until the student wrote his own name on it.

Rationale for the random assignment to classrooms was that conference program leaders wanted to insure that

geographical and personal ties would not hinder participation in the conference program.

During the first three days of the conference, the program consisted of television presentations to the classrooms. Each room was equipped with two television monitors connected to the closed-circuit television cable at Michigan State University.

Programs were presented via the television system at specified time periods during the conference day. After the television presentation, the set was turned off and the students in the individual classrooms broke into discussion groups to consider questions posed.

The experiments in this research were conducted at 2:45 P.M. on June 17 which was the final day of the use of television by the conference. Subjects had received three days of television exposure at the time of the experiments. Since many subjects were assumed to be from rural communities and backgrounds, it was further assumed that a majority would not have had previous experience with instructional use of television in their school systems. Exposure to ITV during the first three days should have dampened the novelty effect of getting instruction via ITV.

Two questions in the test instrument were designed to probe subjects' sophistication with the television medium as a method of instruction. Only about one of every five respondents reported that television was used for

instruction in his school, and about the same number reported having had courses which utilized television. The data, therefore, supported the assumption that a majority had had little experience with television used as an instructional tool.

Classrooms were randomly assigned to Experiment I, Experiment II, and the Control Group. Classrooms were further randomly assigned to 10 different message treatments, five for each experiment. Mean scores of Treatment 3 of Experiment I were used as the "zero irrelevant inclusions" treatment of Experiment II, thereby making a total of six experimental treatments available for the analysis in Experiment II. A table of random numbers was used in making the random assignments.

Three classrooms were assigned to each of the five message treatments of Experiment I. In Experiment II, three classrooms were assigned to three of the message treatments and two classrooms to two treatments. The sixth treatment in Experiment II had previously been designed as an Experiment I treatment and was explained above. The remaining two classrooms composed the Control Group.

To test the homogeneity of the experimental population, means of demographic and information questions by treatment and experiment were compared by the chi square test (Table 9). Non-significant chi squares were obtained indicating no differences in subjects in the various treatment groups when measured on sex, educational level,

previous experience with instructional television, and previous study of Greek temple architecture.

TABLE 9.--Test of homogeneity of subjects by chi square between treatments by experiment.

Characteristic	X^2	df	p
Experiment I			
Sex	3.18	4	n.s.[a]
Educational level	20.98	12	n.s.
Previous TV instruction	0.78	4	n.s.
Previous study of Greek architecture	6.79	4	n.s.
Experiment II			
Sex	0.94	5	n.s.[b]
Educational level	12.52	15	n.s.
Previous TV instruction	7.83	5	n.s.
Previous study of Greek architecture	0.13	5	n.s.

[a] at .05, 4 df, X^2 = 9.49
at .05, 12 df, X^2 = 21.03

[b] at .05, 5 df, X^2 = 11.07
at .05, 15 df, X^2 = 25.00

Test Instrument Construction

A multiple choice test was constructed to test subjects' recall of video and audio information presented in

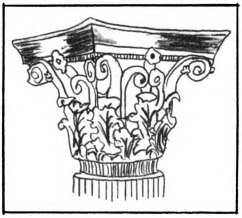
the experimental television messages (Appendix II). Because of the potential large number of subjects, it was decided that answers to the test questions should be marked on an IBM score sheet with machine scoring pencils.

Pictorial Video Comprehension Test

Nine questions were developed to elicit visual recall from the video portion of the messages. Six of the nine questions covering visual information employed the identification of simple line drawings in the question. For example:

Select the correct "order" illustrated by the drawing:

0. Corinthian
1. Gothic
2. Etruscan
3. Doric
4. Ionic
5. Norman



Experimental evidence from educational film research has demonstrated that learning from a multiple channel communication message increases as the similarity between the testing situation and the presentation increases. Hartman notes that, in almost every instance in the studies he reported in his review of multiple channel research literature, testing of visual information has utilized the single channel of print as the method of assessment.

> The weight of the experimental evidence indicates that this form of testing does not measure an adequate amount of multiple channel learning and may lead to erroneous results--particularly when the learning of pictorial information is tested by means of verbal descriptions approximate to it.[29]

The audio script was written so that it would contain no information that would help respondents get correct answers on the two video tests. An item analysis of the six visual questions tested by recognition of a pictorial sketch in the question, pictorial video, was undertaken. Inter-item correlations ranged from .23 to .45 with a median of .38.

Verbal Video Comprehension Test

Three of the nine questions eliciting recall of visual information were written verbal descriptions of the visual information. This method is a traditional one for testing both visual and audio information in multiple channel messages. An example of a verbal video question was:

The most common plan for Greek temples was

0. a rectangular room with columns on the front side only
1. a rectangular room surrounded by vertical columns on four sides
2. a square room with columns on the front side only
3. a square room surrounded by vertical columns on four sides

The inter-item correlations for the three questions which tested visual information with verbal statements, verbal video, ranged from .10 to .26 with a median of .195.

---

[29]Hartman, op. cit., p. 6.29.

Audio Comprehension Test

Finally, six questions eliciting recall of verbal information presented in the audio channel of the message were constructed. An example:

> The Greeks sometimes derived the design for the top element of their columns from
>
> 0. nature
> 1. mythology
> 2. earlier cultures
> 3. religious symbols

The order in which the questions appeared in the test booklet was determined by use of a table of random numbers. Audio, pictorial video, and verbal video questions were mixed together. The correct answer and the foils of the multiple choice were also assigned an order in each question by use of a table of random numbers.

In addition to the 15 test questions covering video and audio information in the experimental television messages, 8 questions were placed at the end of the test instrument to elicit demographic and other information.

A test booklet cover sheet explained the use of the test booklet, the IBM scoring sheet, and the scoring pencils.

The test instrument was pre-tested with two groups of college subjects. No major problems with the test were uncovered. Minor changes were made.

Message Presentation

Five Ampex Videotape Recorders and five separate closed-circuit television channels were available for presentation of the experimental television messages. The playback equipment included three Ampex 1100 and two Ampex 1000 Videotape Recorders. The five channels used were Channels 2, 4, 7, 9, and 11.

Because of the limited time the 4-H conference leaders were able to devote to the research experiments and because of a tight schedule which limited the simultaneous use of the five videotape recorders, two experimental messages were recorded on each of five tapes. The Experiment I messages were recorded on five tapes. Two minutes of black was recorded on each and the five experimental tapes of Experiment II were then recorded on the same five tapes.

The 4-H conference television presentations had been viewed throughout the week on Channel 2 in all classrooms. The researcher was introduced at the end of the final 4-H television presentation. He was seen "live" on Channel 2. In a two minute presentation, he gave a short introduction to the experiments and emphasized the importance of subjects' participation. He also emphasized the necessity for adult classroom leaders to follow previously given instructions.

The researcher had met with the adult classroom leaders at 3:30 P.M. the day prior to the experiments. A

detailed instruction sheet had been presented and discussed with them at that time. Each leader received a copy of the instructions (Appendix III).

The researcher concluded his remarks on television by stating the experiment would begin in one minute. He went immediately to the control room where an assistant had noted the time of the end of the program on Channel 2 and the subsequent fade to black. On a headset, communication was established with two videotape engineers in the videotape room. At the end of one minute, the engineers were given a verbal cue to "roll videotapes." The two engineers manually pressed start buttons on the five machines which all locked in, i.e., synchronization was achieved. There was no signal distortion on either the video or audio tracks of the videotapes during the 13 minutes of playback. (5-1/2 minutes of Experiment I + 2 minutes of black + 5-1/2 minutes of Experiment II = 13 minutes.)

A standby engineer in the control room changed within the one minute interval the video and audio patch for Channel 2 from the studio to the videotape machine on which an experimental tape had already been cued. The other videotape machines had been patched to their respective channels earlier in the day. A check of all channels had been made at 3:00 P.M. on the day prior to the experiments to confirm that audio and video signals for all channels could be fed to all classrooms. The report was affirmative.

In the one minute interval from the end of the program on Channel 2, classrooms in Experiment I switched the television sets to their assigned channels. In that same one minute, Experiment II classrooms turned off their sets and filled the next 6-1/2 to 7 minutes with other classroom activities.

A time keeper in each Experiment II classroom was named by the leader and given the responsibility of turning the set on in those classrooms at approximately seven minutes after the program had ended on Channel 2. This tight timing allowed classrooms to turn sets on or off without jeopardizing the experiments. A minimum 90 second pad was built in by the two minutes of black between experiments. All classrooms were instructed to turn sets off immediately after receiving the television message.

Four associates of the research, two instructors and two graduate teaching assistants at Michigan State University, assisted with the experiments. Three assistants were assigned, each to one of three floors of Bessey Hall. The fourth assistant was assigned the two classrooms in Erickson Hall. Each assistant was to confirm by physically inspecting the classrooms to which he had been assigned that television sets were on or off as specified and that the set was tuned to the correct channel.

The assistants confirmed correct procedure in all classrooms except two. In a control group classroom, 109 Bessey, the adult leader turned the set on during the last

one minute of Experiment I. All subjects in that classroom had not completed the test. The error was discovered by the research assistant and the set was turned off. Subjects then completed the test without viewing the message as they had been instructed.

One audio and one visual question had been constructed from material presented in the last one minute of the 5-1/2 minute television presentation. The second control group classroom did not view any of the television presentation prior to completion of the test.

An examination of the mean scores between the two control group classrooms showed no significant difference between the two groups on either the visual or audio questions. The effect created by erroneously allowing one control group classroom to view the last minute of the experimental television message was minimal or non-existent (Table 10).

TABLE 10.--Control group means by group number of test of video and audio questions.

Group number	Video questions[a]	Audio questions[b]
1	2.33	2.17
2	2.50	2.60

[a] $F = .4451$; df = 1, 58; n.s.

[b] $F = 1.71$; df = 1, 58; n.s.

In classroom 309 which was assigned Treatment 2 of Experiment II, a slight audio distortion was present during the first two minutes of the playback of the videotape television message. The distortion was corrected by the assistant who fine-tuned the channel.

Test Administration

Classroom leaders were instructed to conduct the message testing immediately following the viewing of the experimental television messages. They were to distribute test booklets, IBM answer sheets, and machine scoring pencils. Leaders were to have subjects read along as the instructions on the test cover sheet were read aloud. Subjects were to be reminded to answer 23 test items, to erase carefully if they changed an answer, and to mark only one answer for each question.

A distraction occurred outside the classroom building during the testing of both experimental groups which potentially could have affected the test results. A girl received minor injuries when she was struck by an automobile in the street the classroom building faced.

The confusion created by the accident, including the arrival of police cars and an ambulance, prompted students in some classrooms on the street side of the building to leave their seats to observe the excitement. In other streetside classrooms, adult leaders required subjects to complete the test before they were allowed to go to the

windows. In still other classrooms, students interrupted the test to observe the confusion and then were required to return to their seats to complete the test. Tests were completed by all subjects in all classrooms on the street side of the building.

Classrooms not on the street side of the building were unaware of the accident and the confusion. Two classrooms located in an adjacent building were also shielded from the distraction. An examination of the location of classrooms and their assignment to treatment groups revealed that subjects in one or more classrooms in each treatment group were unaware of the accident.

It was therefore possible to compare pictorial video, verbal video, and audio comprehension test means of groups within treatments to determine whether or not the distraction had affected test scores. It was expected that interference created by the distraction would decrease test means of those groups in classrooms on the street side of the building.

Net differences of means by treatment were obtained by subtracting the mean of the group or groups within a treatment that could have been distracted by the accident from the mean of the group or groups within a treatment which could not have been distracted (Table 11). The net differences were analyzed by a sign test to determine the

consistency of the direction of possible bias. The tests were not significant. The conclusion, therefore, is that the distraction had no significant consistent effect.

TABLE 11.--Net differences of means of groups observing and not observing accident, for each treatment.

Treatment	Pictorial Video	Verbal Video	Audio
	Experiment I		
1	-0.0329	+0.0850	+0.1633
2	+1.5368	+0.2662	+0.8044
3	+0.8063	+0.3346	+0.6172
4	-0.5442	-0.3937	-0.0077
5	+1.2809	+0.4463	-0.1531
	Experiment II		
0	+0.8063	+0.3346	+0.6172
1	-0.6151	-0.0400	-0.9179
2	0.0000	0.0000	0.0000
3	+0.7667	+0.5667	+0.4000
4	-0.4593	-0.0170	-0.3189
5	+0.5743	+0.3146	+0.4889

$\chi^2_{Yates} = 0.6$, df = 1, n.s.

CHAPTER III

FINDINGS

Two experiments were conducted in the research reported here in which video interference was methodically introduced into television messages. Interference to subjects' ability to recall the information presented in the video and audio channels was tested. The results are reported below.

In order to demonstrate that the television messages had an effect, a control group was designated which consisted of 60 subjects. They neither saw nor heard the television messages but were administered the identical test given the experimental groups who viewed the television messages.

Mean comprehension scores for pictorial video, verbal video, and audio content were obtained for control and the combined experimental groups. The differences between the two groups were analyzed by "t" test. All were significant at the .001 level (Table 12). It can be concluded, therefore, that a significant difference existed between the control group and the experimental group.

These findings confirmed that the television messages increased subjects' knowledge of Greek temple

architecture. The thesis of this research, then, is whether rate and ratio manipulation led to differential increases of that knowledge.

TABLE 12.--Comparison by "t" test of control group and pictorial video, verbal video, and audio means by experiment.

Testing Method	Experimental Means	Control Group Means	t	df	p
		Experiment I			
Pictorial video	3.00	1.07	6.875	447	< .001
Verbal video	1.84	1.30	4.353	447	< .001
Audio	3.44	2.38	5.064	447	< .001
		Experiment II			
Pictorial video	2.83	1.07	6.275	479	< .001
Verbal video	1.90	1.30	4.693	479	< .001
Audio	3.37	2.38	4.905	479	< .001

Experiment I

The first experiment investigated the maximum rate at which relevant visual information could be transmitted before recall of that information was impeded. Five message treatments were developed ranging in rate of presentation from 1 visual per 30 seconds to 9 visuals per 30 seconds.

Subjects were tested on information presented in each of two channels, video and audio. Video recall was tested using two methods. Six questions were composed which included visual sketches in the questions. This method was titled pictorial video. Three questions tested video recall using verbal descriptions of the video information presented. This method was called verbal video.

Audio channel information recall was tested by six questions using verbal statements.

Pictorial Video Comprehension

Mean scores for recall of video information utilizing pictorial video questions and the test of significance by analysis of variance are shown in Table 13.

The means which ranged from 3.22 to 2.71 formed a decreasing linear trend and were in the expected direction. However, the test by analysis of variance was not significant. Therefore, rate of presentation had no significant effect on subjects' ability to identify objects pictured in the television messages.

Verbal Video Comprehension

The obtained means for recall of video information tested by verbal video questions and the test of significance by analysis of variance are shown in Table 14.

The means, which ranged from 1.54 to 2.03, increased linearly as rate of presentation was increased and were significant at the .01 level (Figure 1). It can be

TABLE 13.--Experiment I obtained means and analysis of variance of rate tested on video recall using pictorial video questions.

Rate of Relevant Video Information					
	Treatment 1 (N=90)	Treatment 2 (N=91)	Treatment 3 (N=89)	Treatment 4 (N=93)	Treatment 5 (N=89)
Video recall mean scores using pictorial video questions	3.22	3.15	3.03	2.86	2.71

Analysis of Variance					
Source	df	s.s.	m.s.	F	p
Between speeds of presentation	4	16.10	4.03	0.96	n.s.
Within speeds of presentation	447	1871.89	4.19	--	--
Total	451	1887.99	--	--	--

TABLE 14.--Experiment I obtained means and analysis of variance of rate tested on video recall using verbal video questions.

Rate of Relevant Video Information

	Treatment 1 (N=90)	Treatment 2 (N=91)	Treatment 3 (N=89)	Treatment 4 (N=93)	Treatment 5 (N=89)
Video recall mean scores using verbal video questions	1.54	1.74	1.89	2.03	2.00

Analysis of Variance

Source	df	s.s.	m.s.	F	p
Between speeds of presentation	4	14.76	3.69	4.51	<.01
Within speeds of presentation	447	365.77	0.82	--	--
Total	451	380.53	--	--	--

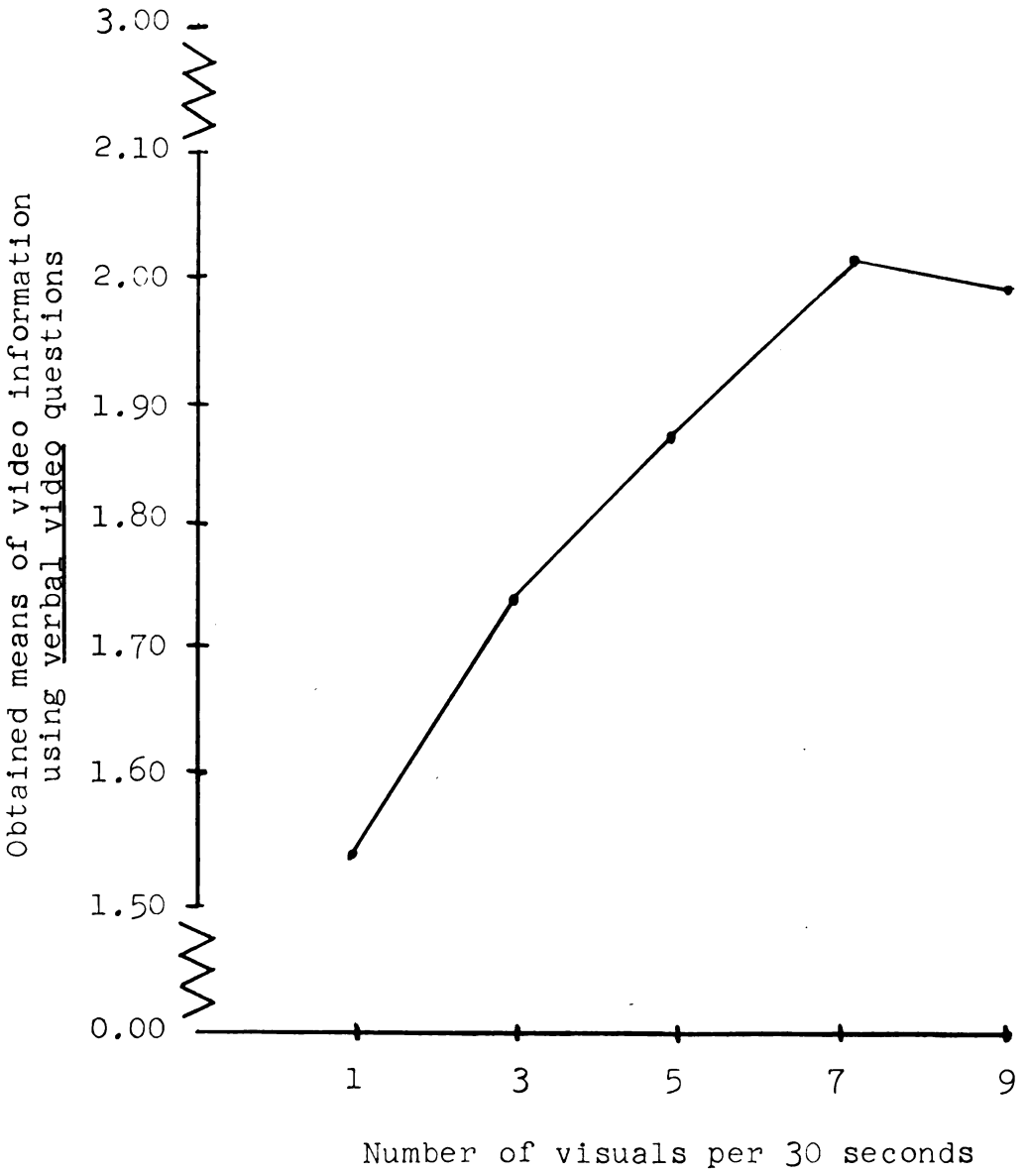


Figure 1.--Effect of speed of presentation on video comprehension.

concluded, therefore, that as rate of presentation increased, visual information in the television messages that could be measured verbally was better comprehended. It was levelling off, however, at about 7 visuals per 30 seconds.

Audio Comprehension

The means for the five treatments testing recall of audio information ranged from 3.26 to 3.56. They are shown with the test of significance by analysis of variance in Table 15. The curve of the means showed no pattern and the statistical test was not significant. It can be concluded, therefore, that increasing the rate of presentation of visual information had no significant effect on subjects' ability to comprehend the audio information presented in the television messages.

Experiment II

This experiment investigated the maximum ratio of irrelevant to relevant visual information which could be transmitted before recall of the relevant visual information was impeded. Six message treatments were developed which ranged from no irrelevant visual inclusions to 5 irrelevant visual inclusions per 30 seconds of television message. All experimental treatments were presented at the rate of 5 relevant visuals per 30 seconds.

Subjects were tested with the identical instrument used in Experiment I. As in Experiment I, tests were conducted on information presented in the video and audio

TABLE 15.--Experiment I obtained means and analysis of variance of rate tested on audio recall.

Rate of Relevant Video Information					
	Treatment 1 (N=90)	Treatment 2 (N=91)	Treatment 3 (N=89)	Treatment 4 (N=93)	Treatment 5 (N=89)
Audio recall mean scores	3.50	3.46	3.44	3.56	3.26

Analysis of Variance					
Source	df	s.s.	m.s.	F	p
Between speeds of presentation	4	4.61	1.15	0.49	n.s.
Within speeds of presentation	447	1043.01	2.33	--	--
Total	451	1047.62	--	--	--

channels. Video recall was tested using the two methods described in Experiment I and labeled pictorial video and verbal video. Audio channel information recall was tested by verbal statements as in Experiment I.

Pictorial Video Comprehension

Mean scores for recall of video information utilizing pictorial sketches, and the test of significance by analysis of variance, are shown in Table 16. Although the means indicated a slight U shaped curve, the statistical test was not significant. It can be concluded, therefore, that increasing irrelevant cues had no significant effect on recall of relevant video information when tested by pictorial video questions.

Verbal Video Comprehension

The means for recall of video information tested by verbal descriptions of the video information, and the test of significance, are shown in Table 17. The statistical test was not significant. An examination of the means showed no pattern. The conclusion is that increasing irrelevant cues had no significant effect on recall of relevant video information when tested by verbal video questions.

Audio Comprehension

The means for the six treatments tested on recall of audio information and the test of significance are shown

TABLE 16.--Experiment II obtained means and analysis of variance of ratio tested on video recall using pictorial video questions.

Ratio of Irrelevant to Relevant Video Information						
	Treatment 0 (N=89)	Treatment 1 (N=98)	Treatment 2 (N=63)	Treatment 3 (N=60)	Treatment 4 (N=87)	Treatment 5 (N=88)
Video recall mean scores using pictorial video questions	3.03	2.87	2.62	2.68	2.82	2.86

Analysis of Variance					
Source	df	s.s.	m.s.	F	p
Between relevant-irrelevant ratios	5	8.04	1.61	0.38	n.s.
Within relevant-irrelevant ratios	479	2017.44	4.21	--	--
Total	484	2025.48	--	--	--

TABLE 17.--Experiment II obtained means and analysis of variance of ratio tested on video recall using verbal video questions.

Ratio of Irrelevant to Relevant Video Information						
	Treatment 0 (N=89)	Treatment 1 (N=98)	Treatment 2 (N=63)	Treatment 3 (N=60)	Treatment 4 (N=87)	Treatment 5 (N=88)
Video recall mean scores using verbal video questions	1.89	2.06	1.70	1.92	1.82	1.97

Analysis of Variance					
Source	df	s.s.	m.s.	F	p
Between relevant-irrelevant ratios	5	6.13	1.23	1.40	n.s.
Within relevant-irrelevant ratios	479	420.32	0.88	--	--
Total	484	426.45	--	--	--

in Table 18. The analysis of variance test produced a significant F at the .01 level. However, the curve of means shows no pattern (Figure 2). The expected decreasing trend in comprehension when irrelevancies were increased was not found.

Additional Statistical Analysis

Because of the large amount of error variance in the data reported for both Experiment I and Experiment II, the obtained means for both experiments were analyzed by analysis of covariance.

Because the groups were not perfectly comparable on the program-interest dimension (Table 19), interest in the television messages was used as the control for the analysis of pictorial video scores and verbal video scores. A correlation of .30 was found to exist between program interest and video recall.

Mean scores for recall of video information using pictorial video questions in Experiment I were tested by analysis of covariance, Table 20. The test was not significant, but approached significance. The chances are less than one in ten that the different rates of presentation had no effect on pictorial video comprehension when treatment groups are made comparable on program interest.

The mean scores for recall of video information using verbal video questions in Experiment I, tested by covariance with interest in program as the control, are shown in

TABLE 18.--Experiment II obtained means and analysis of variance of ratio tested on audio recall.

Ratio of Irrelevant to Relevant Video Information						
	Treatment 0 (N=89)	Treatment 1 (N=98)	Treatment 2 (N=63)	Treatment 3 (N=60)	Treatment 4 (N=87)	Treatment 5 (N=88)
Audio recall mean scores	3.44	3.76	2.84	3.50	3.11	3.43

Analysis of Variance					
Source	df	s.s.	m.s.	F	p
Between relevant-irrelevant ratios	5	39.56	7.91	3.66	<.01
Within relevant-irrelevant ratios	479	1035.89	2.16	--	--
Total	484	1075.45	--	--	--

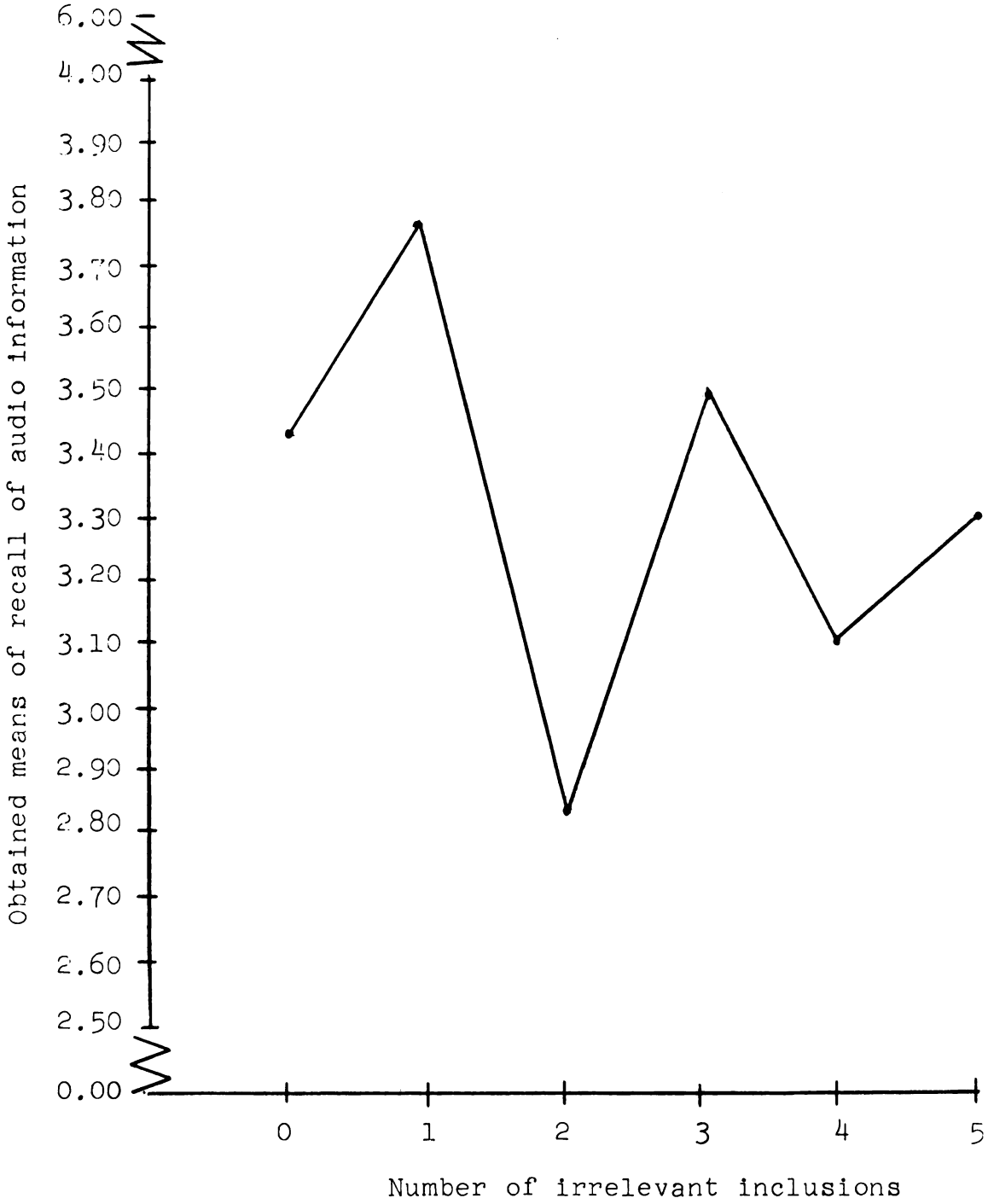


Figure 2.--Effect of irrelevant stimuli on audio comprehension.

Table 21. Again, significance was not achieved but the chances are less than one in ten that the rates of presentation had no effect on verbal video comprehension.

In Experiment II, Tables 22 and 23 indicate that the test by covariance for the two video testing methods, using interest in the program as the control, produced non-significant F's.

TABLE 19.--Obtained means of interest in television program by experiment and treatment. (Lowest mean indicates highest interest in program.)

Treatment	Experiment I	Experiment II
0	--	1.15
1	1.36	1.07
2	1.40	1.40
3	1.15	1.15
4	1.11	1.24
5	1.26	1.29

TABLE 20.--Experiment I analysis of covariance of rate tested on video recall using pictorial video questions as dependent variable and interest in program as control.

Source	df	s.s.	m.s.	F	p
Between speeds of presentation	4	5.78	1.45	2.07	n.s.
Within speeds of presentation	446	311.60	0.70	--	--
Total	450	317.38	--	--	--

TABLE 21.--Experiment I analysis of covariance of rate tested on video recall using verbal video questions as dependent variable and interest in program as control.

Source	df	s.s.	m.s.	F	p
Between speeds of presentation	4	5.80	1.45	2.07	n.s.
Within speeds of presentation	446	311.69	0.70	--	--
Total	450	317.26	--	--	--

TABLE 22.--Experiment II analysis of covariance of ratio tested on video recall using pictorial video questions as dependent variable and interest in program as control.

Source	df	s.s.	m.s.	F	p
Between relevant-irrelevant ratios	5	5.16	1.03	1.38	n.s.
Within relevant-irrelevant ratios	478	357.75	0.75	--	--
Total	483	362.91	--	--	--

TABLE 23.--Experiment II analysis of covariance of ratio tested on video recall using verbal video questions as dependent variable and interest in program as control.

Source	df	s.s.	m.s.	F	p
Between relevant-irrelevant ratios	5	5.17	1.03	1.38	n.s.
Within relevant-irrelevant ratios	478	357.78	0.75	--	--
Total	483	362.95	--	--	--

CHAPTER IV

SUMMARY, CONCLUSIONS, AND IMPLICATIONS FOR FURTHER RESEARCH

Interference in the video channel of television messages and its relationship to comprehension of information presented in those messages was the problem investigated in this study. Two experiments were designed and executed to examine two types of video interference.

Visual and audio stimuli were recorded on videotape and transmitted to subjects who viewed the television messages on television receivers in 30 different classrooms. Subjects were randomly assigned to classrooms, groups, treatments, and experiments.

Summary

In Experiment I, the independent variable manipulated was the speed with which relevant video information was presented. It was felt that "overloading" a channel by increasing the rate of video presentation would produce interference with comprehension.

Rate was manipulated by increasing the number of visuals presented in five different message treatments. The number of visuals presented per 30 seconds in the five treatments were 1, 3, 5, 7, and 9. Dependent variables were recall of relevant video information and recall of audio

information. Relevant video information was tested using two methods, pictorial-sketch questions and totally verbal questions. These methods were labeled pictorial video and verbal video.

For the pictorial video questions, the data showed that as the number of visuals increased, the recall means decreased, but not significantly.

For the verbal video questions, the test means increased significantly as the number of visuals increased. The increase was linear and leveled off at about 7 visuals per 30 seconds (Figure 1).

Audio information questions showed no significant differences among treatment means.

In Experiment II, the independent variable was ratio of irrelevant to relevant video information. Irrelevant visual stimuli in television messages have been suggested as possible sources of interference. The suggestions have stemmed mainly from studies which have discovered post hoc that irrelevancies influenced other variables under investigation. In this study, however, irrelevancies were designed into the television messages as an experimental variable.

Six different message treatments were developed. Five types of irrelevant stimuli were superimposure of words, boom shadow, ornate frame, letters or numbers on visuals, and shadow of gesturing hand.

Ratio of irrelevant to relevant cues was manipulated by increasing the number of irrelevant cues per 30 seconds in the six message treatments. The ratio was increased by one for each treatment, i.e., 0:5, 1:5, 2:5, 3:5, 4:5, and 5:5. All treatments were presented at the rate of five relevant visuals per 30 seconds on the basis of pretest data.

The data of Experiment II demonstrated no significant differences among means when testing for video recall using pictorial video and verbal video questions.

When ratio of irrelevant to relevant video information was tested as to its effect on recall of audio information, the difference among the treatment means was significant. The curve of the means showed no pattern, however (Figure 2).

Discussion

Audio-visual theory predicts that testing visual information of multiple channel messages by verbal descriptions approximate to the visual information may not detect the effect of the video presentation. Testing visual information using visual stimuli should uncover video effects.

> If the two situations in which information is (1) presented for learning and (2) then presented again for testing are looked upon as two complex but similar sets of stimuli, the learning demonstrated in the second or testing situation may be expected to increase as the testing situation becomes more identical to the situation in

> which the information was learned. This leads to the expectation that single channel testing such as the usual printed questions will not elicit fully the learning from a multiple channel medium. It is also to be expected that adding cues to the stimulus to be learned enhances its probability of evoking the response since there are more handles available for the learner to grasp.[31]

In testing video information in the experiments in this study, both types of questions were used. Six questions, called pictorial video, employed pictorial sketches. Three questions, called verbal video, used the traditional verbal method.

In Experiment I, the means for the pictorial video questions were linear and in the expected direction, i.e., interference introduced by increasing the rate produced a decrease in recall. The question to be determined is why the statistical test was not significant. One possible explanation may be the method used to manipulate the rate which was expected to result in interference.

One to 9 visuals were progressively shown in 5 treatments for a 30 second period for each sub-topic. The visuals for each sub-topic were very similar in content but varied in form. It is possible the visuals did not vary enough in form and that subjects perceived the visuals as additional examples. As a result, respondents may have been assisted in overcoming the interference expected to occur as the rate was increased, thus cancelling out the

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[31]Hartman, op. cit., p. 6-16ff

negative effect. The additional examples may have provided more cues for use in identification of the pictorial video questions.

Some evidence supports this position. An educational film study by Kopstein, Sulzer, and Lumsdaine demonstrated that intra-film repetition by use of added examples increased learning in films on micrometer reading.

> These investigators showed that the "point of diminishing returns" for adding of further instructional examples depended on difficulty of the material and intelligence of the learner, but that in any case there was value in giving more examples than often is done in the "once over lightly" type of training film treatment.[32]

The verbal video questions in Experiment I produced means which were significantly different, linear, but not in the expected direction. As the rate increased, which was expected to produce increased interference, the recall means increased. The means for the 5 treatment groups ranged from 1.54 to 2.03. A "t" test showed the experimental groups significantly different from the control group at the .001 level which confirms the variation in the experimental group means was produced by the experimental manipulation of the rate.

Verbal questions, tapping video content, probably tap more generalized learning and more instances of a concept may be necessary if a television message receiver is to generalize successfully from video information.

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[32]Miller, op. cit., p. 96.

The significant result obtained in Experiment I using verbal video questions suggests that this method of testing may be the appropriate one when the purpose of video information is to teach people generalizations, which seem to require that several instances of the concept be shown to receivers.

Increasing the rate of presentation of video information had no significant effect on recall of audio information. To produce an interference effect in the audio channel would probably require a higher rate of presentation than was designed for this study.

The one significant finding in Experiment II was an effect of the ratio of irrelevant to relevant video information on recall of audio information. Because of the pattern of the means, however, interpretation of the finding may not be possible. The randomness of the curve precludes an explanation other than conjecture (Figure 2).

The highest mean was obtained when one irrelevancy was included and the lowest mean was obtained with two irrelevancies. As the ratio of irrelevancies increased to 3:5 the mean increased but fell off again with the 4:5 and 5:5 ratios.

An examination of the means of both experiments in this study disclosed a considerable amount of error variance. Subjecting the data to a test by analysis of covariance using interest in the program as the control did

not extract sufficient error variance to produce significant differences among the treatment means.

Factors which may have contributed to error variance, over which the experimenter had no control, include:

1. Control of subjects by classroom leaders. Each classroom was supervised by a lay person who had been selected to participate in the conference. Some of the leaders can be assumed to have been "dedicated" to their assignment. Others may have conditioned subjects to participate minimally in the experiment. No measure of classroom leaders' attitude and behavior was made.

2. Quality of video and audio signals. Each classroom leader and/or one or more subjects in each classroom had been responsible for fine tuning the television receiver in each classroom during the conference. Since the experiment followed immediately one of the 4-H presentations, there was no time to insure that each set was receiving maximum quality video and audio signals.

Conclusions

The following conclusions can be drawn from the data reported:

1. Interference, introduced by increasing the speed of video presentation, produced a significant effect when recall of video information was tested using verbal video questions. As the number of visuals increased, the recall increased. This was an unexpected finding since it was anticipated that as speed of presentation increased, recall would decrease. Verbal video questions require respondents to generalize from the information they have received. This may be the reason that, as more examples were observed, more comprehension resulted.

2. No significant interference was produced when the relationship of speed of presentation and recall of video information was tested using pictorial video questions. Pictorial video questions require respondents to identify information. It is possible that subjects were assisted in the identification task by the method used for manipulating speed of presentation. Speed was increased by presenting additional visuals which were judged to be very similar in content but varied in form. The visuals may have been too similar in form and perceived by respondents as additional examples. The positive implication of this finding may be that speed of video presentation can be increased without significant interference in comprehension if a sufficient number of similar visuals are used in the television message. If this is true, the possibility of presenting additional information within the same time period in a television program should assist educators in coping with the knowledge explosion.

3. Speed of presentation in the video channel had no significant interference effect on comprehension of information presented in the audio channel. This finding further supports the conclusions arrived at above with respect to video information since the total television program--both video and audio information--suffers less interference from speed of presentation than expected. These data suggest that television viewers have a capacity

for accepting information from both channels and without significant interference in comprehension greater than the amount of information presented in the fastest TV message in this experiment.

4. The ratio of irrelevant to relevant stimuli in the television messages had no significant effect on comprehension of the video information presented. This was true for both pictorial video and verbal video questions. All treatments of the ratio experiment were presented at the speed of 5 relevant visuals per 30 seconds. The maximum irrelevant-relevant treatment included 5 irrelevancies with 5 relevant visuals every 30 seconds. In that version of the program, 5 superimposures were shown over 5 relevant visuals, 5 ornate frames were presented with 5 visuals, 5 visuals had numbers or letters on them, 5 were shown with a boom shadow, and 5 were shown with the shadow of a gesturing hand. Interference was expected to increase as the ratio of irrelevant cues increased. This did not occur. It may be that as the ratio increased, subjects perceived them as part of the relevant visual, i.e., they expected them in the picture and they were there. These data suggest that television viewers may be able to tolerate more irrelevancies than expected.

5. A significant effect on audio information comprehension was obtained by increasing the ratio of irrelevant to relevant visual stimuli. The random pattern of the

means, however, does not lend itself to any meaningful interpretation.

Implications for Further Research

The two experiments reported in this study were designed to establish base lines for future research. No studies were found in a search of the literature which had experimentally manipulated speed and irrelevant cues as interference variables. The findings of this study suggest an optimum interference level which viewers can tolerate before recall is impeded. Using the data and methodology of this study as base lines, investigators in future studies can concentrate on other variables in the video and audio channels of television messages to develop the needed research literature.

Until further experimentation is done, the generalizability of the findings of this study may be limited in some ways. Manipulation of speed of visual presentation, for example, exceeded rates usually employed in television messages. The irrelevant cues were deliberately selected as obvious distractions. Studies investigating speeds of visual presentation and kinds of irrelevant stimuli that were not studied here should be undertaken to determine their effect on message recall.

In the research reported here, the message topic was picked with the probability that subjects were unfamiliar with it. Studies are needed which use topics that are

familiar as well as unfamiliar to subjects. For the people studied in this research, a television message about farm machinery might have resulted in higher message recall than did the message about Greek temple architecture.

Other effect variables such as attitudes, message enjoyment, and attention to message should also be investigated.

Different types of audiences should be studied. Subjects in the study reported here were high school students. Their age and familiarity with the television medium undoubtedly produced a far different effect than if the subjects had been more than 60 years of age.

Other production variables should be isolated and investigated if television is to develop into the respected academic tool it potentially is. The quality of the medium depends not only on effective messages and sophisticated electronic hardware but also on production techniques not yet validated.

APPENDICES

APPENDIX I

VIDEO	AUDIO	
SLIDE: SET A TRAP TO CATCH A GOD	NO AUDIO FOR 5 SECONDS	
DISSOLVE TO NARRATOR	NARRATOR: Set a trap to catch and keep a god. That was the basic intention of the early Greek temple. Greek gods and goddesses who roamed and ruled the universe had virtues and they had faults. One of the greatest faults was that they were not always attentive to their worshippers. It was therefore necessary to attract the gods to places of beauty if one were to get their attention. Such was the reasoning of the ancient Greeks whose temples provide a visual history of another age.	0.05 0:30
DISSOLVE TO SLIDE OR SLIDES DEPENDING ON TREATMENT	NARRATOR: Surviving Greek temples, many of them built between 500 B.C. and 300 B.C. are monuments to one of the great periods of architecture.	 0:39

VIDEO	AUDIO	
	Wars and other disasters took their toll over the centuries so that today only portions of these classical buildings remain.	0:48
	In the bright, Grecian sunlight, the remnants of the temples remind tourists and scholars of a highly sophisticated civilization.	0:57
	The ancient Greeks developed different styles or "orders" of architecture for their temples but the basic plan was similar for all.	1:00 1:09
	In the typical floor plans, shown here, thick lines are walls, the circles are columns, and the fine lines indicate steps.	1:18
	The principal room contained a statue of the god or goddess for whom the temple was built; other rooms provided accessory space for treasure.	1:27
	All of the temples were designed to employ what is called post-lintel construction.	1:30 1:39

VIDEO

AUDIO

In other words, uprights or columns were placed on a base and beams were placed horizontally across the uprights. 1:48

Over the beams, a low-pitched roof was constructed similar to those found in many houses today. 1:57

The ancient Greeks developed three different styles or "orders" of architecture which differed primarily in the appearance of the columns. 2:10

These columns are called Doric and the top element of the column is called the capital. 2:19

One of the main differences among the three orders was in the design of the capitals; these are called Doric order capitals. 2:28

The Ionic order is also identified by its capital which is different from the capitals of the other orders. 2:30 2:39

In these examples, one can appreciate the workmanship which went

VIDEO	AUDIO
	into the design of these capitals. 2:48
	The columns of the Ionic order were used in a great many of the temples built by the early Greeks 2:57
	The third "order" or style is called Corinthian and was used less by the Greeks than the other orders. 3:00 3:09
	Again, the most obvious difference is in the design of the capital at the top of the Corinthian column. 3:18
	The Greeks probably used designs from nature in developing the patterns for the capitals of the different orders. 3:27
	In addition to the capital, the three orders also differed in the design of the base of the column. 3:30 3:39
	Here you see examples of Doric order columns and how they stand on the temple foundation. 3:48
	The Doric columns have no base as such and appear to stand solidly on the floor of the temple. 3:57

VIDEO	AUDIO	
	These are examples of the design of the base of the Ionic order column.	4:00 4:09
	The Ionic column base contributes to the symmetry and beauty of the column.	4:18
	This column and its base were widely used in classical Greek temples.	4:27
	The Corinthian order column and base, shown here, are similar in some respects to the Ionic order column and base.	4:30 4:39
	In the Corinthian column base, however, additional artistic workmanship is noted.	4:48
	This order was not as widely used by the Greeks for their temples as were the other two orders.	4:57
DISSOLVE TO NARRATOR	NARRATOR: In this brief examination of Greek temple architecture, it is apparent that a talented group of architects lived in Greece many centuries ago. The massive columns of the temples, contrasted with the	5:00

VIDEO	AUDIO	
	intricate, fine sculpturing, attest to their skill and artistry.	
	It is a fitting tribute that many buildings are constructed today which use architectural features copied from classical Greek temples.	5:30
FADE TO BLACK		

APPENDIX II

PLEASE READ THE FOLLOWING INSTRUCTIONS

1. You should have on your desk a test booklet, an answer sheet, and a special pencil. Record all your answers on the answer sheet with the special pencil. Do not write on the test booklet.

2. Item No. 1 on the answer sheet is followed by 10 spaces from 0 through 9. Carefully blacken with your pencil one of the spaces as your answer. In every question, one of the possible answers is 0. None of the questions has an answer above space 7. Do not mark more than one response to each question. Be certain to erase completely if you change an answer.

3. SPECIAL NOTE: Question 1 is on the left half of the answer sheet, question 2 is on the right half, question 3 is on the left, question 4 on the right, and so forth.

4. Turn in the test booklet, your answer sheet, and the scoring pencil to your classroom leader when all have finished.

THERE ARE 23 ITEMS TO ANSWER

1. Greek temples were designed to employ what is called

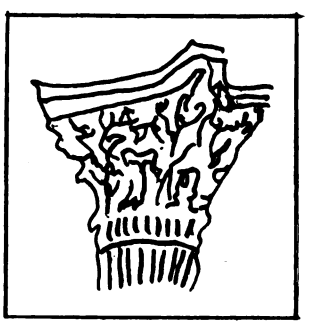
   0. hammer-beam roof construction
   1. tie-beam roof construction
   2. stone and vault construction
   3. post and lintel construction

2. The basic intention of the Greek temple was

   0. to attract a god to a place of beauty in order to get his attention
   1. to serve as centers for classical Greek religious services
   2. to stimulate artistic and sculptural talents of Greek architects
   3. to provide places of beauty where Greek scholars could contemplate

3. Select the correct "order" illustrated by the drawing:

   0. Corinthian
   1. Gothic
   2. Etruscan
   3. Doric
   4. Ionic
   5. Norman



4. The most common plan for Greek temples was

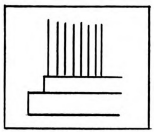
   0. a rectangular room with columns on the front side only
   1. a rectangular room surrounded by vertical columns on four sides
   2. a square room with columns on the front side only
   3. a square room surrounded by vertical columns on four sides

5. Greek temples were usually built

   0. at the base of a hill
   1. in the center of town
   2. on top of a hill
   3. in a protected valley

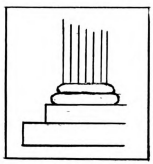
6. Select the correct "order" illustrated by the drawing:

0. Corinthian
1. Doric
2. Gothic
3. Ionic
4. Etruscan
5. Norman



7. Select the correct "order" illustrated by the drawing:

0. Norman
1. Doric
2. Etruscan
3. Ionic
4. Corinthian
5. Gothic



8. The Greeks sometimes derived the design for the top element of their columns from

0. nature
1. mythology
2. earlier cultures
3. religious symbols

9. Select the correct "order" illustrated by the drawing:

0. Corinthian
1. Gothic
2. Etruscan
3. Doric
4. Ionic
5. Norman

10. Corinthian order columns were

    0. used in about half the surviving Greek temples
    1. used in a great many Greek temples
    2. used less by the Greeks than the other orders
    3. not used by the Greeks

11. Greek temples were built with

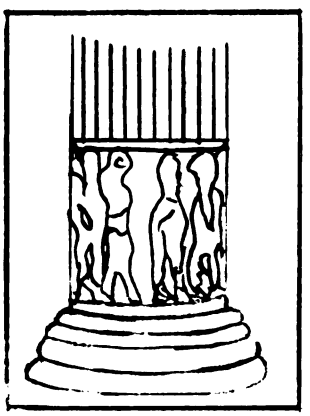
    0. no roofs
    1. flat roofs
    2. dome roofs
    3. triangular roofs

12. The principal room of Greek temples contained

    0. treasure collected for a god
    1. seating for worshippers
    2. a statue of a god or goddess
    3. open walkways for worshippers

13. Select the correct "order" illustrated by the drawing:

    0. Doric
    1. Ionic
    2. Corinthian
    3. Norman
    4. Etruscan
    5. Gothic

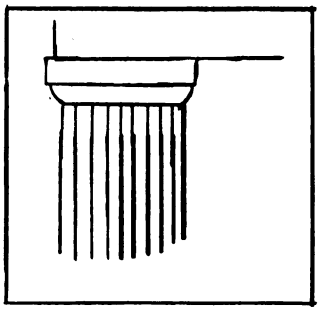


14. Many of the surviving Greek temples were built between

    0. 300 A.D. and 500 A.D.
    1. 700 A.D. and 900 A.D.
    2. 500 B.C. and 300 B.C.
    3. 900 B.C. and 700 B.C.

15. Select the correct "order" illustrated by the drawing:

0. Doric
1. Corinthian
2. Etruscan
3. Norman
4. Ionic
5. Gothic



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16. What was your high school class this past year?

0. Freshman
1. Sophomore
2. Junior
3. Senior

17. What is your age?

0. under 14
1. 14
2. 15
3. 16
4. 17
5. 18
6. over 18

18. What is your sex?

0. Male
1. Female

19. Have you ever studied Greek architecture in a course in high school:

0. Yes
1. No

20. Did you think the TV program moved

0. too fast
1. too slow
2. just about right

21. Did you think the TV program was

0. very interesting
1. fairly interesting
2. not very interesting
3. not at all interesting

22. Is TV used for instructional purposes in your school?

0. Yes
1. No

23. Have you taken any courses which used TV for all or part of the instruction?

0. Yes
1. No

APPENDIX III

TELEVISION RESEARCH PROJECT

Your cooperation in the television research project scheduled for 2:45 p.m. Friday, June 17 is very much appreciated. As the classroom leader, you will have a few duties to perform which are essential and critical to the project.

Each classroom has been designated to participate in either Experiment I or Experiment II. This information will be clearly marked on the packet of materials which will be delivered to your classroom tomorrow about 1:10 p.m. In addition, the television channel number which you will turn your sets to for the experiment will be marked on the envelope.

In the envelope are 40 test booklets and 40 answer sheets to be marked with a special scoring pencil. The pencils will be delivered at the same time as the envelopes. The students will not receive the test materials, of course, until they have watched the television lecture which is 5-1/2 minutes long.

All classrooms will be watching the 4-H conference program on Channel 2 tomorrow afternoon. The 4-H television hostess will introduce me and I will give a very short orientation about the research project. When I have concluded, the picture will fade to black and the research project begins.

Experiment I Classrooms

The following classrooms in Bessey have been randomly assigned to Experiment I; Rooms 108, 115, 117, 203, 209, 214, 215, 216, 302, 303, 310, 311, 316, and 317. In Erickson Hall, room 240.

When the picture has faded to black on Channel 2, Experiment I classrooms will have one minute to change the television sets to the channel number assigned. Recall that the Channel number is written on the envelope of test materials.

The 5-1/2 minute program will begin after the 1 minute of black. Adjust the sets, if necessary, for good picture

and sound. Those classrooms which will be assigned to watch Channel 2 will not have to re-set the Channel, of course.

The program ends with the narrator on screen and his final sentence is, "It is a fitting tribute that many buildings are constructed today which use architectural features copied from classical Greek temples." The picture then fades to black.

Turn off the sets immediately. Distribute the test booklets, the answer sheets, and the special pencils. Ask the students to read along as you read aloud the instructions on the test booklet. Answer any questions and have the students begin.

It is important that the students answer all 23 items. Emphasize they must erase carefully if they change an answer because the score sheets are machine graded. Also emphasize they should have only one answer per question.

When the students have finished the exam, collect the test booklets, answer sheets, and scoring pencils. The research assistant who checked your classroom to confirm you had the correct channel will collect the packets from you in the classroom. Put the answer sheets and test booklets in the envelope.

Please read the following to the class when everything is completed:

"The researcher thanks you for your help in this experiment today. Students in 30 classrooms participated in this experiment. Different classrooms got different versions of the television lecture. Some lectures contained more information than others. Some had distracting things in the pictures. The purpose of this research is to find which of the ways of presenting a televised lecture is best in teaching students the information contained in the lecture."

Experiment II Classrooms

The following classrooms in Bessey have been randomly assigned to Experiment II: Rooms 110, 111, 116, 103, 202,

208, 211, 217, 308, 309, 314, and 315. In Erickson Hall, room 132.

When the picture has faded to black on Channel 2, Experiment II classrooms will have one minute to turn off their television sets. Some other activity in the classroom will be necessary for the next six or seven minutes.

When the 4-H conference program on Channel 2 fades to black, have one or more of your students check the time. In 7 minutes (a few seconds won't matter) turn your sets to your assigned channel. The point here, obviously, is that we don't want Experiment II students to see any of the programs which Experiment I has been watching.

Experiment II programs are scheduled to begin $8\frac{1}{2}$ minutes after we faded to black on Channel 2. Recall that your channel assignment is written on the packet of materials. Have the students watch the $5\frac{1}{2}$ minute program which ends with the narrator on screen saying, "It is a fitting tribute that many buildings are constructed today which use architectural features copied from classical Greek temples." The picture then fades to black.

Turn the sets off and distribute the test booklets, the answer sheets, and the special pencils. Ask the students to read along as you read aloud the instructions on the test booklet. Answer any questions and have the students begin.

It is important that the students answer all 23 items. Emphasize they must erase carefully if they change an answer because the score sheets are machine graded. Also emphasize they should have only one answer per question.

When the students have finished the exam, collect the test booklets, answer sheets, and scoring pencils. The research assistant who checked your classroom to confirm you had the correct channel will collect the packets from your classroom. Put the answer sheets and test booklets in the envelope.

Please read the following to the class when everything is completed:

"The researcher thanks you for your help in this experiment today. Students in 30 classrooms participated in this experiment. Different classrooms got different versions of

the television lecture. Some lectures contained more information than others. Some had distracting things in the pictures. The purpose of this research is to find which of the ways of presenting a televised lecture is best in teaching students the information contained in the lecture."

Control Group

The following classrooms in Bessey have been designated control groups: Rooms 109 and 210.

When the picture has faded to black on Channel 2, Control Group classrooms should turn the television sets off. Distribute the test booklets, the answer sheets, and the special pencils. Ask the students to read along as you read aloud the instructions on the test booklet. Answer any questions and have the students begin the test.

It is important that the students answer all 23 items. Emphasize they must erase carefully if they change an answer because the score sheets are machine graded. Also emphasize they should have only one answer per question.

When all have finished and you have collected the test booklets, score sheets and pencils you may turn the set to Channel 2 and watch the lecture. The research assistant who checked your classroom to confirm your set was off will collect the packets from you in the classroom. Put the answer sheets and test booklets in the envelope.

You should then read the statement which explains the purpose of the research.

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PLEASE DO NOT DISCUSS THIS INFORMATION WITH STUDENTS

We appreciate the help of the classroom leaders in this research. Because there are two experiments and we can only play five programs at a time, it was necessary to divide you into two groups. The directions have been specific to save you time and effort and also because research must be rigidly controlled if it is to have meaning.

Thank you again.

Robert Schlater

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