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**LA THÈSE A ÉTÉ
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**An Experimental Study to Determine if Non-Obtrusive
Captions can Influence Learning from Instructional Television**

Paul J. Vinet

**A Thesis
in
The Department
of
Education**

**Presented in Partial Fulfillment of the Requirements
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ABSTRACT

An Experimental Study to Determine if Non-Obtrusive Captions can Influence Learning from Instructional Television

Paul J. Vinet

A 23 minute educational videotape was presented in three treatment versions to 58 senior high school students.

The first group viewed the presentation with superimposed non-obtrusive (subliminal) reinforcing captions, the second group with superimposed visible (supraliminal) reinforcing captions, and the third group with no captions at all. A videotape copy of the three treatment presentations accompanies this study.

A randomized posttest-only control group design with one independent variable (captioning treatment) was utilized. The dependent variable, effectiveness, was measured with a multiple choice knowledge recall test.

Analysis of variance revealed no significant differences among the three captioning treatments.

It was concluded that there is a need for further research into these captioning techniques using posttests matched to student abilities.

TABLE OF CONTENTS

Chapter 1	
INTRODUCTION	1
1.1 Context of the Problem	1
1.2 Statement of the Problem	9
1.3 Scope of the Study	9
1.3.1 Relevance of Stimulation	10
1.3.2 Method of Stimulus Presentation	11
1.3.3 Relevance of Post-Test	13
1.4 Limitations of the Study	14
1.4.1 Subliminal Stimuli	14
1.4.2 Individual Threshold Variation	16
Chapter 2	
REVIEW OF RELATED LITERATURE	18
2.1 Multi-Channel Communication	18
2.1.1 Cue Summation Theory	19
2.2 Captions	22
2.2.1 Captions on Film	22
2.2.2 Captions on Television	24
2.3 Subliminal Perception	28
2.3.1 Human Behavior	29
2.3.2 Motivation	30
2.3.3 Elaborative Thinking	31
2.3.4 Cognitive Functions	34
2.3.5 Affective Domain	44
2.4 Summary	46
Chapter 3	
HYPOTHESES	51
3.1 Statement of the Hypotheses	51
3.1.1 Rationale for the Hypotheses	52
3.2 Operational Definitions	56
3.2.1 Independent Variable	56
3.2.2 Dependent Variable	56
3.2.3 Control Variables	57
3.3 Operational Restatement of Hypotheses	58
Chapter 4	
RESEARCH METHODOLOGY	59
4.1 Sample	59

4.2 Design	60
4.2.1 Experimental Design	60
4.2.2 Treatment Conditions	60
4.3 Instrumentation	62
4.3.1 Pilot Study	62
4.3.2 Post-Test	63
4.4 Materials	65
4.4.1 Television Presentation	65
4.4.2 Preparation of TV Presentation	67
4.5 Procedure	68
4.5.1 Selection of Sample	68
4.5.2 Physical Setting of the Study	69
4.5.3 Equipment	70
4.5.4 Procedure	70
Chapter 5	
RESULTS	73
5.1 Group Randomness	73
5.2 Observations	74
5.3 Primary Analysis	75
5.3.1 Hypotheses	75
5.3.2 Test Reliability	75
5.3.3 Analysis of Variance	76
Chapter 6	
CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS	79
6.1 Conclusions and Discussion	79
6.1.1 Initial Group Characteristics	80
6.1.2 Hypothesis #1	80
6.1.3 Hypothesis #2	84
6.1.4 Hypothesis #3	85
6.2 Recommendations for Future Research	87
Chapter 7	
REFERENCES	90
Appendix A	
DEFINITION OF TERMS	96
Appendix B	
POST-TEST	98
Appendix C	
CAPTIONS AND RELATION TO POST-TEST QUESTIONS	102
Appendix D	
SUPERIMPOSED VISIBLE CAPTIONS	103

LIST OF TABLES

Table 1
SEX TYPE DISTRIBUTION 73

Table 2
ANALYSIS OF VARIANCE 78

Table 3
MEAN SCORES 78

X

Chapter 1

INTRODUCTION

1.1 Context of the Problem

For many years it has been commonplace for instructors to provide for repetition, practice or review of instructional sequences. The accepted conclusion is that, no matter which mode of instruction is used (i.e. lecture, demonstration, video, film)...

...the need for repetition of material to assure mastery is well established by the experimental literature (Lumsdaine, 1963, p.643).

Reinforcing captions (see Appendix A for a definition of terms used in this study) have been tested in many different settings, and have been proven to be an effective aid to instruction via television (cf. Chu & Schrama, 1967, p.29; Coldevin, 1976, p. 90, 1981, p.89). Captions can be used to clarify, review and/or summarize the important points in a television program and they are especially valuable for this medium due to the fact that normally television in itself does not provide corrective feedback to the student.

The use of such captions relates to multiple channel communication, which involves the simultaneous presentation of information over two or more perceptual channels (Dwyer, 1978, p.22), and Severin's, cue summation principle of learning:

...learning is increased as the number of available cues or stimuli is increased. (Severin, 1967(a), p.237)

Mechanic (1965) has found that learners allowed to learn incidently respond to fewer stimuli characteristics than do directed learners. Dwyer (1978) recommends that cueing strategies, such as the use of captions, be used to focus learner attention on individual stimuli (p.158).

The use of captions is very much an instructional television technique. However captions are not normally integral to more general entertainment television programs. These programs place considerably less responsibility for effort and activity on the audience compared to instructional programs which require the audience to recall and apply the material presented (Schramm, Lyle & Pool, 1963, p.1).

Steiner (1963) in a study of the attitudes and behavior of more than 2000 American adults, found that people verbalized more interest in cultural or educational programming than their viewing behavior indicated. Steiner found that in general, there is an inverse relationship between audience size and the cultural merit of the program.

The viewing population as a whole favors light entertainment by an overwhelming majority (82%) (Steiner, 1963, p.125).

Similarly, Schramm, Lyle and Pool (1963) found that 98% of educational television viewers listed their favorite programs as entertainment programs offered on commercial television (westerns, mysteries and variety shows).

Lesser (1974) has pointed out that commercial broadcasters must be sensitive to these types of audience preferences because the television industry is dependent almost exclusively upon advertising revenues for financing (p.xxv). Broadcasters do not routinely have a captive audience: viewers are free to switch channels at any time and for that reason advertisers are naturally attracted to the station which offers the types of programs which Steiner and Schramm, et al, have found to draw in these large numbers of viewers.

More recent studies (Bower, 1973; The Roper Organization, 1975) have found little or no change from Steiner's findings in viewers' attitudes towards educational/cultural programming.

A significant point made by Steiner is the fact that

The "average American viewer"... would like TV to be more informative and educational but not at the expense of entertainment. (Steiner, 1963, p.228)

The growth of educational technology has led to educators questioning the traditional uses of media, and to the development of new methods for the improvement of learning from media. The question arises: might it not be possible to develop means of making entertainment television programs more instructive without affecting audience preferences?

...attempts to explore possible, rather than typical effects may be feasible as well as educationally valuable. It may be found that when media are used in one or another unique way, which may not be very typical of the present usages of mass or instructional media, novel effects can be produced. (Salomon, 1972, p. 403)

If captions could be made so non-obtrusive as to be invisible, or subliminal, to the viewer, then it may be possible to turn an entertainment program into an instructional one by focussing viewer attention on specific points. This could resolve objections by broadcasters and advertisers, and in addition audiences might ask for these captions to be placed in programs, especially if the captions helped them to learn from the television program.

The use of subliminal perception as an instructional technique has not been thoroughly investigated, and while its use could be potentially very dangerous on broadcast television, there are many other applications in which subliminal techniques would be not only useful, but beneficial.

Subliminal perception has been, and still is, known by many

names with many associated definitions. The term refers to the perception of stimuli too weak in intensity or too brief in time to be consciously noticed, yet strong enough to influence behavior (see Appendix A).

Dixon (1971) traces the history of subliminal perception as far back as 400 B.C., and includes Democritus, Plato, Aristotle, Montaigne and Leibniz as early non-psychologists who have speculated on the possibility of subliminal perception (pp. 6-7). Experiments in subliminal perception have been reported in psychological bulletins since 1863 (Application of Subliminal Perception, 1958).

The phenomenon of subliminal perception became a matter of hot public debate in 1956, when, in the United States, James M. Vicary conducted an experiment in a movie theater in which he flashed messages reading "Eat popcorn" and "Drink Coca-Cola". Mr Vicary claimed dramatic increases in sales (18% for soft-drinks and 57% for popcorn) during tests of 45,000 people in movie theatres (Rose, 1958, p.276). No detailed account of this experiment has been published and Mr. Vicary, owner of the company which manufactured the subliminal message device, may very well have had highly suspect findings in terms of adherence to rigorous criteria for scientific research.

The Press quickly reacted to subliminal stimulation as a sinister scientific development which could control minds. Although there was much disagreement amongst psychologists

over the efficacy (and even the existence) of subliminal perception, in the U.S., the Federal Communications Commission decided not to permit the use of any subliminal perception system of advertising. All three television networks banned its use and the Code Board of the National Association of Broadcasting barred audio subliminal advertising over radio. (Rose, 1958, p. 276-7)

Subliminal perception has been the center of controversy for most of its history and is one of the most challenging areas in the literature of perceptual research (Chaplin & Krawiec, 1968, p. 178).

> So deeply rooted is this distaste for the idea of external unperceived control (particularly in a culture which sets the goal of personal freedom above all else) that it is understandable that there should have been so many attempts to cast doubts on the validity of this intriguing phenomenon which has continued to confront, and in some cases affront, twentieth century psychologists. (Dixon, 1971, p. 322)

The result of such a long-standing controversy has been an inordinately large number of studies, both pro and con, devoted to subliminal perception (cf. the many studies reviewed in Adams, 1957; Eriksen, 1960; Bevan, 1964; Dixon, 1971, 1981). There can be little doubt, however, that the study of subliminal perception has matured to a level of relative sophistication, evidenced by the fact that studies are no longer directed toward the empirical establishment of its possibility but, rather, toward investigating its

implications for human behavior. Little research, however, has been undertaken on the application of subliminal perception to education, although it may well have an important role to play in the learning process.

Anderson (1972), after reviewing the literature pertaining to production treatments for instructional television, recommended that

... the relationships of visual communication techniques to theoretical models of perception and learning should be investigated more thoroughly than in the past. (p. 58)

With the advent of the "microcomputer age", the educational technologist has discovered another tool to help manage the instructional interaction of students and stimuli. The impact of the personal computer has many ramifications for education and society, one being that it has opened the door to widespread use of subliminal perception techniques.

Recently a device has become available which allows personal computer owners to display subliminal captions on their own television sets while they are watching a broadcast program. This product, the Expando-Vision (manufactured by Stimutech Inc. of East Lansing, Michigan), comes packaged with a number of self-help programs to aid the viewer in following diet programs, quitting cigarette smoking, improving study habits, controlling stress and even improving his or her golf game. At present, purchasers of

the unit are limited to messages programmed by the manufacturer, but there is no technical reason why it should not soon become possible for people to program the unit themselves, for whatever self-instructional or self-motivational applications they may have.

In addition, computer software could be created by instructional designers to complement certain types of television programs in order to promote understanding or learning. The possibilities for the educational use of subliminal techniques include the direction of the viewer's attention, repetition of concepts in a speeded-up fashion, and the promotion of affective goals.

It would seem that both broadcasters and viewers of instructional television, as well as instructional designers, could benefit from an investigation of non-obtrusive captions, which with computer-controlled devices such as the Expando-Vision, could be implemented in the home by the viewer, rather than on a mass scale by broadcasters.

1.2 Statement of the Problem

The purpose of this study was to determine, through measurement of performance on a knowledge recall test, the effectiveness of the insertion of superimposed non-obtrusive (subliminal) reinforcing captions into an educational videotape.

1.3 Scope of the Study

This study makes extensive use of research conducted in the areas of multiple-channel communication, cue-summation, captions for film and television and subliminal perception. In this section reference will be made to a number of the studies which are reviewed in greater detail in the literature review found in Chapter 2.

An underlying purpose of the study was to relate the research to foreseeable practical uses of subliminal stimulation for educational purposes. To this end, two criteria were identified as important:

1.3.1 Relevance of Stimulation

Non-obtrusive captions should be related to the supraliminal stimulation (images and commentary in the video program) in such a manner that the subject matter is enhanced to the viewer.

Severin's (1967) cue-summation theory holds that learning increases as the number of available cues is increased in the learning situation. Severin qualifies these cues as having to be relevant to the learning situation. Research into captioning techniques for film and television supports Severin's theory as the following studies have found captions, or cues, to enhance learning from these media: Kurtz (1950), Northrop (1952), McIntyre (1954), Schwarzwald (1960), Tidhar (1973), Wagner (1974), Coldevin (1975a, 1975b). In addition Findahl and Hoijer (1976) and Lojddquist (1969) (both reviewed in Coldevin, 1981) found that the superimposition of related key words improved retention of television news items.

The use of subliminal perception techniques for educational purposes would, in all probability, combine relevant subliminal messages with appropriate subject matter. A large number of the studies conducted on subliminal perception have used unrelated stimuli (see Literature Review in Chapter Two), but of the studies which have found subliminal stimulation to have an effect, a great proportion

have used related subliminal/supraliminal stimulation: (Kolars (1957); Klein, Spence, Holt and Gourevitch (1958), Sharp (1958), Smith, Spence and Klein (1959), Murch (1960) and Moore (1983).

1.3.2 Method of Stimulus Presentation

This study presented non-obtrusive captions superimposed and recorded over a videotaped television program. The technique was a true superimposition, rapidly cut to and away from a discrete supraliminal stimulus.

Rapid cutting, was accomplished through the use of a custom manufactured electronic device which turned the superimposition on and off at regular, preset intervals. It was considered that this technique would closely approximate what would be visually acceptable to viewers as well as technically feasible (commercially available computer equipment).

The technology employed in North American television systems dictates that the shortest possible time for one image to exist on the television screen is .033 sec., or one video frame (Ennes, 1971). It is possible to send an image to a television monitor at speeds faster than .033 second, but the resultant displayed image would then not be erased until the next television frame, or .033 second later. Because visual perception thresholds vary greatly from individual to individual, as well as with the testing situation (Erikson,

1960; Bevan, 1964), .033 second was considered to be within the conscious discrimination range of a significant number of people (see studies by Kolers 1957; Murch, 1965 and Tavis, 1970).

Researchers who found significant effects at this presentation speed were Klein, Spence, Holt & Gourevitch (1958), Smith, Spence & Klein (1959) and Kolers (1957). Logically, one would assume that the slower the presentation speed (the longer a stimulus was presented), the more chance for a subject to glean information from the caption. But there is evidence to suggest that this is not the case.

Zuckerman (1960) found that the effect of subliminal captions decreased as they became more supraliminal. Sharp (1959), Byrne (1959), Zuckerman (1960), Murch (1965) and Skinner (1969), all found significant effects at much higher presentation speeds (.02 and faster).

The phenomenon of subliminal effects being greater when presented well below, rather than just below the supraliminal threshold has been demonstrated by several studies other than Zuckerman's (Smith and Henriksson, 1955; Paul and Fisher, 1959; Spence and Holland, 1962; Zwosta and Zenhausen, 1969).

It could well be that the greater effort required by reality-contact behavior is a deterrent to perception of the stimuli. Fiss (1966) pointed out that

it is the bypassing of critical judgement and reality testing that enhances responsiveness to subliminal stimulation.

In this study the stimuli (non-obtrusive captions) were superimposed at low intensity (brightness) for .033 sec., thus reducing the likelihood of subjects consciously discriminating the exact nature of the captions. The speed of .033 second was a constant (imposed by the North American television system), and was treated as being above the conscious visual perception threshold of the subjects. The brightness, or luminance, of the caption was thus the determining factor for non-obtrusiveness. This is consistent with Ledford (1978).

1.3.3 Relevence of Post-Test

The post-test used in this study is presented in its entirety in Appendix B. The test was of the knowledge recall type and contained 22 multiple choice questions concerning information presented in the videotape presentation. For 16 of the questions the correct answers were presented as captions simultaneously with the information being given both visually and aurally from the videotape program. The two experimental groups saw the videotape with different captioning treatments, while the control group saw no captions at all. Because the post-test measured knowledge

recall, subjects viewing the captioned treatments (which gave 16 of the correct answers as captions) were expected to score higher than the control group.

Content of both the videotape and the post-test was validated by the teachers responsible for the experimental subjects. The questions were judged to be difficult, but within the capabilities of the students.

1.4 Limitations of the Study

1.4.1 Non-Obtrusive Stimuli

The social/psychological dangers of broadcasting subliminal messages have been well documented (McConnell, Cutler & McNeil 1958; Rose, 1958), and, consequently, one would assume that embedded subliminal, or non-obtrusive, captions would never become a reality on broadcast television. The most feasible use of subliminal messages for instructional purposes would be through a computer-controlled device in a viewer's home. However, practical limitations made it impossible to test the use of subliminal captions through such an instrument, as the sole device available at the time of the study was capable only of presenting pre-programmed captions. Use of this device would have restricted the experimenter to the presently available captions, none of

which was suitable for the present study. In this experiment the method of presenting the videotape program and non-obtrusive (subliminal) captions was an attempt to replicate as much as possible the type of presentation which might conceivably be created with this device.

Another limiting factor in this study was the absence of any cueing strategy for the subjects receiving the non-obtrusive stimulation. Mechanic (1965) found that learners permitted to learn incidentally respond to fewer stimuli characteristics than learners who have been directed to the stimuli. Webster and Cox (1974) concluded that advance organization as a cueing strategy produced significant effects when used with captions.

If a future use of non-obtrusive captions would be in the home, at the viewer's discretion, then the viewer would be aware of the stimulation, and would have, after a fashion, cued himself to the captions. In this study, however, the non-obtrusive captions treatment group was not cued. It was felt that the cueing of this group would have added an unnecessary variable to the study, as the control group would have received no cueing at all. It is possible that different results may have been obtained if the non-obtrusive captions treatment group had been cued.

1.4.2 Individual Threshold Variation

The problem of individual differences in perceptual threshold makes large-group testing with the same stimulus material difficult at best. It is almost impossible to find an intensity or duration value for the subliminal caption which is "subliminal" for all of the subjects all of the time. This study, however, was directed towards the use of mass-produced, standardized subliminal materials and equipment. If there is a future for subliminal learning, it almost certainly would have to be on the limited basis of use by individuals or small groups. The only cost-effective method for reaching the individual would be to provide standardized hardware/software, which, it would appear likely, would not be truly subliminal for everybody.

This is a limitation of the possible wide-spread use of subliminal stimuli, and consequently, this limitation was built into the study. There was no attempt to explore individual thresholds, but rather one presentation level was established for all subjects. This "average" presentation level was determined through the pilot study documented in Chapter 4, Section 3.1 of this study.

Although much of the background research for this study came from the area of subliminal perception, it was felt that because the study did not address itself to individual thresholds, the captions could not be considered truly

subliminal. For this reason the captions in this study are referred to as "non-obtrusive".

Chapter 2

REVIEW OF RELATED LITERATURE

2.1 Multiple-Channel Communication

This study is concerned with the use of captions on television. For the purpose of the study, captions are considered to be defined as visual printed statements which are either superimposed or inserted into a video presentation. Because captions are commonly used for the immediate reinforcement of concepts presented, both aurally and visually, in the presentation, they must be studied in the light of multiple-channel communication.

Multiple-channel communication involves the simultaneous presentation of information over two or more channels of sensory input (Dwyer, 1978, p. 22). After reviewing a number of studies relating to multi-channel communication, Fleming and Levie (1978) conclude that perceptual capacity appears to be greater when two channels or modalities (the most common being sight and sound) are used for information presentation (p. 61).

Hsia (1968) commented on the importance of one communication

channel reinforcing information carried on a different channel:

...in dual or multiple channel information processing, dimensionality of information generally increases, and one channel provides cues and clues for the other, provided that the amount of information to be presented has not reached the capacity limit, thereby eliminating probable interference or information jamming. Increase in dimensionality usually results in the increase of information processing. (p. 326)

This statement implies that since the learner has the opportunity to avail himself of any combination of the available cues to achieve his learning task, as the number of cues increases, so does the probability that the learner will interact with the cues appropriate to achieving the task. However, as Hartman (1961) has demonstrated, interference may occur when multi-channel information is simultaneously presented and the information from each channel is unrelated.

2.1.1 Cue Summation Theory

Severin's (1967a, 1967b) cue summation theory predicts that learning will be increased as the number of available cues or stimuli is increased in a particular learning situation. He considers the relationship between information in both channels, and concluded that multi-channel communications which combine words with relevant illustrations will provide the greatest information gain, due to the summation of cues

between channels. He cautions against the use of unrelated cues in both channels, as well as the simultaneous use of redundant words in two channels such as would be the case with words presented both aurally and in print (Severin, 1967a, p. 243).

In contrast, Travers (1964) found no significant differences between a combined audio-visual treatment and visual alone, although both treatments were more effective than auditory alone. Travers' studies suggest that there may be no advantage in the use of two channels as compared with the visual channel alone. There may be very limited application of these findings, however, due to the fact that they deal with nonsense syllables and so do not approximate reality. In some ways nonsense syllables may also be regarded as "unrelated cues" in that they really do not relate to anything at all.

Card (1966), in studying the learning of foreign language vocabulary, found that learning could be facilitated by the simultaneous presentation of the visual word and its aural counterpart. It seems that in certain circumstances, in this case a paired associate task, redundancy between channels may be beneficial. While seemingly at odds with Severin's conclusion that

multi-channel communications which combine words in two channels (words aurally and visually in print) will not result in significantly greater gain than a single channel communication since the

added channel does not provide additional cues.
(Severin, 1967, p. 243)

it should be noted that Severin expanded this conclusion by specifying that if the material is difficult or exceeds the audience's level of literacy, a combined audio-print presentation would produce better results than print alone. Card's (1966) findings, then, are consistent with Severin's theory.

Dwyer (1978) has added that

It is apparent that students cannot efficiently respond and learn from visualized instruction if they have difficulty in identifying the crucial learning stimuli with which they are to interact.
(p. 159)

The manipulation of the stimuli presented over multiple channels in order to motivate the learner to attend to and interact with selected stimuli is known as "cueing". A number of researchers have found evidence to support the use of cueing to improve student achievement (cf. Dwyer, 1972). Dwyer (1978) contends that there are two basic cueing strategies: one which provides additional relevant stimuli to improve and make more complete student understanding of the information which he is receiving, and another which does not provide additional information to the student, but rather emphasizes the instructional stimuli so that they will be quickly perceived. This second type of cueing strategy encompasses the use of captions in a video program.

2.2 Captions

A number of studies have been conducted to determine the effectiveness of captions in facilitating learning from videotape or film. Both film and video are media which are capable of presenting a great range of information over both aural and visual channels.

2.2.1 Captions on Film

Kurtz (1950) tested the effect of inserted questions and reinforcing statements (captions) with six versions of a film. He found that both the inserted-questions version and the inserted-statements version were effective in facilitating learning, and provided superior results to a simple showing of the film without statements.

Mcintyre (cited in Chu & Schramm 1967) tested three versions of a film on military trainees. The treatments were: humor (written into the script), captions (inserted into the film) and blank visuals (totally blank frames inserted into the film). The captioned version was significantly more effective than both the blank visuals treatment and the humorous treatment.

However, Miller & Levine (cited in Chu & Schramm 1967) found no significant differences in learning when they tested

various versions of a training film on Ohm's Law with a sample group of military trainees. Three versions of a subtitled film were tested: 1) no captions at all, 2) major captions (main points), 3) complete captions (detailed reviews). This experiment was later replicated by Miller, Levine and Sternberg (cited in Chu & Schramm 1967) in order to test the effect of review. Again, no significant differences were found between versions with or without captions.

Northrop (1952), showed three different training films to naval recruits. Each had three versions: no captions, captions with outline of main points, captions with main point outline and subpoint outlines. He found that captions yielded a significant difference in learning when used with a less-organized film. The simple and well-organized film yielded slightly better results without captions, although these results were not significant.

In noting Northrop's findings, Chu and Schramm (1967) have suggested that the different findings by McIntyre, Miller and Levine and Miller, et al, could be due to the possibility that one of the films was not so well-organized while the other was. This is not inconsistent with Severin's (1967) cue-summation theory and the findings of Card (1966). One would assume that a less-organized film is more difficult for the viewer to comprehend.

2.2.2 Captions on Television

Schwarzwalder (1960) examined two levels of visual reinforcement for their effects on learning from television. He used two videotapes: the first a simple television lecture, the second with captions superimposed over the same presentation. Analysis of the data was not significant at the .10 level, but did indicate superior learning as a consequence of the super-imposition of reinforcing graphics.

Tidhar (1973) found that super-imposed "visual reminders" increased interest and attention when compared to television programs which did not contain them. Tidhar also found that these programs stimulated significant information gains.

Wagner (1974) examined the comparative effects of voice-over, super-imposition and combination redundancy statements in an instructional video program. The three treatments were compared to a simple program which contained no redundant statements of any form. Both the super-imposition and combination treatments resulted in significant differences in learning over the simple program.

Coldevin (1975a) compared three levels of review presentation for television with a control program which was identical except that it had no review segments. Review

segments were presented as: 1) audio-only, 2) superimposition of captions and 3) combined audio and superimposed captions. Results demonstrated a significant superiority of both superimposition and combined treatments in relation to the control program and the audio-only treatment.

In another study, dealing with the efficacy of varied organization and placement strategies for review segments (captions) in instructional television programs, Coldevin (1975b) again found that super-imposed review strategies, when compared to a simple treatment with no review strategies, facilitate significant information acquisition. Coldevin noted that a weakness of the study was the longer running-times of the treatment programs (4 minutes longer than the control program), which gave rise to increased learning opportunities.

Coldevin (1981) conducted an extensive review of experimental research in television message design in which he noted the findings of Findahl and Høijer (1976) and Lojdqvist (1969). Both of these studies were conducted at the Swedish Broadcasting Corporation. According to Coldevin, the researchers found that the super-imposition of key words improved retention of news items.

Color was examined as a variable in caption design by Webster and Cox (1974). Two experiments were conducted. In the first 3 videotapes integrating summaries on captions was

shown to three treatment groups. The control group saw the videotape with the captions all in one color. The second group had the main caption a different color from the rest. The third group had the main caption alternating its color, and was therefore different from the rest of the text. Results from this experiment indicated no significant differences in recall among the groups. Because the videotape material was judged to be well within the capabilities of the students, a second experiment was conducted.

The second experiment used a single program with a higher level of difficulty. In this experiment, color was used for the backgrounds and the lettering was white. The control group saw the videotape with the captions on a green background. The second group saw the captions with 3 different background colors (green, cyan, blue) assigned to different levels of importance. The third group saw the same videotape and captions as the second group, but they were told in advance the relation of the colors to the levels of importance. Webster and Cox found no significant differences between recall from an unexplained color and recall from the control version (one color only). However, the third group, who had been informed of the reason for the color changes, produced a significant difference in recall of the most important statements.

From these experiments, Webster and Cox concluded that the

use of a color change alone to distinguish more important from less important television captions is not effective in increasing recall of the most important information, but if the attention of subjects is directed towards the colors used on captions to denote more important points, then recall of that information is significantly better than that of subjects who were not directed to the color change or subjects who saw the captions with no background color changes.

This research indicates the potency of advance organization as a cueing strategy, but it should be noted that only the group which was told the purpose of the color changes had been given any indication that there were points in the program which were more important than others. This does not in any way invalidate the results insofar as advance organization is concerned, but it does make it quite clear that it was the advance organization and not the color which contributed to the higher recall.

2.3 Subliminal Perception

Strictly speaking "perception", predicated by "subliminal", is a contradiction in terms, for, if the subject is unaware of a stimulus, then how can he be said to perceive it? (Dixon, 1971, p. 12)

This contradiction in terms - the concept of perception without conscious awareness - has aroused indignation in some researchers, and enthusiasm in others.

There are many reviews of experimentation in subliminal perception which have contributed summaries of various points of view. Six sources are Adams (1957), McConnell, Cutler and McNeil (1958), Bevan (1964), Eriksen (1960), Dixon (1971), Dixon (1981).

Subliminal stimuli may be aural or visual: the criterion applied to them is that, under the conditions of the experiment, they cannot be consciously discriminated by the subjects. Because this study was concerned with visual captions for television, only those experiments involving visual subliminal stimuli have been reviewed.

Early experimentation in the field was aimed at providing evidence of the reality of the phenomenon. Often cited is the study conducted by McGinnies (1949). Galvanic Skin Responses of subjects were recorded during the subliminal visual presentation of "taboo" words such as "penis" and

"whore", and "neutral words" such as "music" and "store". McGinnies found that the Galvanic Skin Responses indicated that the "taboo" words were perceived, even though the subjects could not consciously discriminate them.

2.3.1 Human Behavior

More recently, experiments have no longer focussed on the empirical establishment of the existence of subliminal perception. The notion that people can respond to stimuli without being able to report their existence is both accepted and well-documented (Bevan, 1964; Dixon, 1971, 1981; Erdelyi, 1974; Nisbett and Wilson, 1977.) Experimentation now tends to focus on determining the relationships between subliminal perception and behavior.

Klein, Spence, Holt, & Gourevitch (1958) projected through a tachistoscope drawings of human figures designed to be sexually ambiguous. The subliminal stimulus for each drawing was a drawing of either male or female genitals. The subliminal stimulus was flashed once, for a duration varying between .02 and .035 sec. This was immediately succeeded by the human figure drawing, presented for .33 sec. (considered by the researchers to be supraliminal). The researchers reported that the subliminal flashing of the drawings of male and female genitals had influenced the subjects' concepts of the human figures utilized.

In a similar study, Smith, Spence & Klein (1959) presented

via tachistoscope the words "happy" and "angry" prior to the supraliminal projection of an expressionless face. Each word was projected 21 times. It was found that the subliminal flashing of the words influenced the subjects' descriptions of the faces as being either pleasant or unpleasant.

2.3.2 Motivation

Byrne (1959) demonstrated that subliminal stimulation could influence motivation. During the showing of a 16 minute film, he exposed experimental subjects to the word "beef", superimposed for $1/200$ of a second, every 7 seconds. After seeing the film, subjects rated themselves on a hunger scale and were encouraged to choose from a variety of sandwiches which the experimenter provided.

The subliminal stimuli were considered to have had a significant effect on subsequent hunger ratings, but were ineffective on choice behavior. The researcher suggested that choice behavior in choosing a sandwich might well have been determined by habit reinforced over the years, and that subliminal stimulation might determine preferences between equally familiar and desirable alternatives.

2.3.3 Elaborative Thinking

Zuckerman (1960) gave experimental subjects the task of describing in writing a series of pictures from the Thematic Apperception Test. These pictures were presented tachistoscopically a total of ten times at supraliminal levels. One phase of the experiment had three conditions: Condition 1 - TAT card alone, Condition 2 - TAT card with "WRITE MORE" superimposed for .02 sec., Condition 3 - TAT card with "DON'T WRITE" superimposed for .02 sec. The control treatment was identical except that the subliminal instructions were replaced by blank flashes. Zuckerman reported a consistent increase in the amount of material written by the control group for successive pictures. Experimental subjects exhibited a decrease in the quantity of material written when the subliminal instruction was changed from "WRITE MORE" to "DON'T WRITE". The second phase of the experiment was identical, except that the duration of the "subliminal" instruction was increased to .5 sec.. 10 of the 18 subjects still did not report observing the suggestion stimuli when questioned. These ten were analyzed as a subliminal group, the remaining eight as a supraliminal group. Results indicated that the suggestion effect only appeared when the suggestion was subliminal, in other words: as long as they were subliminal, they had the desired effect, but at the supraliminal level, they had no consistent influence on behavior. One interpretation of

this effect is that we can only exercise our choice of acceptance or rejection of a suggestion stimulus if we consciously perceive that stimulus.

There has been some criticism of the Zuckerman experiment (Moore, unpublished) based on the so-called "ceiling effect". This effect occurs when performance reaches a maximum and cannot be further improved. Moore suggests that because the experimental group started the experiment by writing more than the control group during Condition 1 (TAT card alone), and both groups increased output during Condition 2, the experimental group reached an asymptote and were "all written out" by the time Condition 3 ("DON'T WRITE") was applied.

While this criticism is illuminating, it is of the type that derives from implicit assumption rather than objective fact. Moore assumes that the drop in writing output by the experimental group was not due to the subliminal command "DON'T WRITE" but was no more than a statistical artifact: the only variability possible was downward. But what Moore presents as fact is really only a possibility and it is also entirely possible that he is wrong - the experimental subjects may very well have been capable of writing more at the time of Condition 3. Without actually testing the subjects for their writing "ceilings" it is difficult to accept this criticism as conclusive evidence against Zuckerman's experiment. What is clear from Moore's

criticism, however, is that Zuckerman had differences between his groups prior to applying the treatment conditions. Moore points out that when differences between groups are large before experimental manipulation, it is risky to attribute subsequently observed differences to that manipulation.

Moore's paper is a strong attack on subliminal advertising, but this should not be confused with subliminal perception. Moore does agree that numerous studies have proven that subliminal perception can affect behavior. He makes a point of stating that the purpose of his paper is to examine subliminal perception experiments in relation to the claims made for its effectiveness for advertising. He fails to point out that in none of the documented experiments on subliminal perception is there to be found a single experimenter making the claim that subliminal directives offer advertising a unique and powerful tool with enduring effects.

The studies of both Byrne (1959) and Zuckerman (1960) are not powerful arguments for the positive effects of subliminal advertising. These studies suggest that when in competition with other stronger or incompatible tendencies, the effects of marginal stimuli (ie subliminal) are minimal or even non-existent. After reviewing the research of both Byrne and Zuckerman, Dixon notes:

It would seem reasonable to conclude that, in the absence of a strong existing habit structure and/or contrary drive state, a subliminal stimulus can impart direction to overt behavior. (Dixon, 1971, p. 177)

It would also seem reasonable to conclude from the studies of Byrne and Zuckerman that, at best, subliminal stimuli aimed at affecting choice behavior are extremely weak.

2.3.4 Cognitive Functions

There have been a number of experiments relating to the influences of subliminal stimulation on problem-solving and cognitive learning.

Kolers (1957) used a three-field tachistoscope to subliminally present 40 subjects with the correct solutions to various supraliminal problems in which the subject had to find the common figure amongst a set of complex geometric figures. Kolers used a "metaconstrast" technique in which a subliminal stimulus is combined with a masking supraliminal stimulus. The phenomenon of metaconstrast, as Kolers describes it, is as follows: if two stimuli are presented serially and tachistoscopically at appropriate time values, the first is not reported. If, however, the first stimulus is presented alone, it is always reported. The subliminal stimulus is apparently inhibited by the preceding supraliminal stimulus, rather than because of its brevity of duration or low intensity. In this experiment, the subliminal solution was exposed for .03 sec. and masked by

the problem, which was exposed for .30 sec. Kolers found that the subliminal presentation of the solution to a problem resulted in significantly more correct answers than when no subliminal presentation was made.

In a replication of Kolers' study, Gerard (1960) added an additional experimental group to which he presented incorrect solutions to a geometric problem. Gerard's purpose was to find out if a subject could be influenced contrary to the normal course of his perceptual and reasoning processes. Gerard spliced single frames of motion picture film together, in order to achieve exact exposure durations, and projected the resulting film. Gerard's exposure time for a single problem was as follows: first pattern (solution) - .034 sec.; pause (interruption of the shutter) - .008 sec.; second pattern (problem) - 1.492 sec.; pause (interruption of the shutter) - .008 sec.; blank field (in order to allow time for the subject to report) - 2.008 sec.; pause (interruption of the shutter) - .008 sec.. He ran six consecutive exposures of each of six problems for a total of 125.5 sec. Results indicated that the control group scored higher than each of the subliminal groups, although the subliminal group shown correct answers scored higher than the subliminal group shown incorrect answers. Gerard's results are a partial confirmation of Kolers' findings that subliminal presentations could affect performance on problem solving tests.

Sharp (1959) investigated the effects of subliminally-presented numbers representing correct or incorrect answers to supraliminally-presented multiple-choice test questions. He prepared three filmstrips with fifty test questions on each. The questions were based on subject matter for a course in which the students were enrolled. The questions were presented via a filmstrip projector for 25 to 35 seconds each. At the same time Sharp projected via tachistoscope the number of a multiple choice response which was either right or wrong. The subliminal stimulation was presented three times for each question, for .018 sec. at approximately 7 second intervals. He reported that the subliminal presentation of the numbers representing multiple choice responses had significantly influenced the test performance of the subjects. Sharp's results do not necessarily indicate that students' knowledge or understanding of the material was altered by the subliminal stimuli. It seems more probable that choice behavior was affected, and it is possible that subliminal stimulation affected only those students who did not know the correct answers to start with.

Murch (1965) conducted a study to determine if answers to mathematical problems could be influenced through subliminal stimulation. He used three experimental groups of 10 undergraduate students each. A series of three simple mathematical problems was presented via tachistoscope for 5, 10 and 20 seconds respectively. Murch states that

simultaneously he presented the subliminal stimulus (the solution to the problem) at an exposure speed of .005 second. It is not clear however, whether Murch presented the subliminal stimulus just once or repeatedly. Subjects in Group One were asked to solve the problems, those in Group Two were asked to volunteer guesses as to the correct answers, and the subjects in Group Three were asked to select answers from a list of possible answers provided. Murch found that subjects in both Groups One and Two demonstrated a significant tendency to repeat subliminally presented digits in their answers. Subjects in Group Three demonstrated a significant tendency to select answers which had been subliminally presented. Murch theorised that there should be a positive relationship between subliminal and supraliminal stimuli. Murch's subjects were given subliminal stimulation which was relevant to the task in which they were involved, and so were already mentally operating on content similar to the subliminal stimulation.

An interesting study pertaining to learning was conducted by Skinner (1969). In an attempt to determine whether student vocabularies could be improved through the subliminal presentation of words and their meanings during the presentation of a videotape, six hundred subjects were randomly assigned to six treatment groups. The videotapes were two Abbott and Costello comedies and were unrelated to the subliminal stimuli. Two of the groups viewed the videotape as slides of the words and their meanings were

flashed subliminally at .005 sec. Two other groups viewed the videotape with the slides flashed at supraliminal levels. These four groups all had each word repeated twice every five seconds for a period of one minute (24 exposures per word). The final two groups viewed the videotape with no slides flashed. Skinner reported that both the subliminal and supraliminal groups achieved significantly greater post-treatment scores than did the control groups. Also, there were no significant differences between the supraliminal and subliminal groups.

A similar study was conducted by Tavis (1970). He attempted to determine whether a science concept could be taught subliminally to fourth-grade students while watching an unrelated film. The presentation of the subliminal stimulus was unconventional in that Tavis, rather than superimposing the stimulus onto the film, projected it on the screen just below the film.

One experimental group viewed the 20 minute film while the science concept "Pigs are Smart" was flashed subliminally at .1 sec. once every sixty seconds for a total of twenty exposures. Another experimental group had the science concept presented supraliminally only once, for an exposure of sixty seconds, sixteen minutes into the film. The control group viewed the film without either subliminal or supraliminal exposures of the science concept. Evaluation was conducted by asking the students to complete an

objective-type test and to reproduce any extra letters or words which they had seen on the screen. The researcher reported that the results indicated that it was unlikely that subliminal learning had occurred. However, the unconventional presentation of the subliminal stimuli may have affected Taris' results. He stated that projecting the stimulus below the lower edge of the film image would favor subliminal perception of them, but it is entirely possible that the visual attention of the subjects was concentrated within the film frame, and consequently the subliminal science concept was in their peripheral field of vision. This would be consistent with Underwood (1976), who showed that peripherally placed words interfered with the naming of centrally fixated pictures.

A novel approach to experimentation with subliminal stimuli was conducted by Severance and Dyer (1973). The investigation was based on the Stroop color/word test. The Stroop test demonstrates an interference effect of involuntary reading on the task of naming colors. Essentially the Stroop test consists of a number of various colored words presented sequentially. Some of these words are the names of colors. The interference effect takes the form of a subject taking longer to report the color of a word such as "red", when it is written in an incongruent color such as blue, than the same subject would take to report the word "rod" written in blue. This effect, known as the Stroop effect, will also appear when incongruent

color words are presented preceding color stimuli (Dyer and Severance, 1973). In testing subliminal exposures of the color/word stimuli, it was found that the interference effect disappeared (Severance and Dyer, 1973). One assumes that it is the meaning of the color word stimulus which gives rise to interference in color naming, therefore the results of this experiment seem to indicate that meaning cannot be gleaned from subliminal messages. However, while there are arguments that complementary subliminal and supraliminal stimuli may in fact interfere with each other (Philpott and Wilding, 1979), the majority of subliminal experiments point to the relative weakness of the subliminal stimuli and to the absence of any effect when presented in conjunction with competing, stronger supraliminal stimuli (Byrne, 1959; Zuckerman, 1960). This is certainly the case with the Stroop effect: the stronger supraliminal color stimuli simply overpower the subliminal distractors. The Severance and Dyer experiment is also open to criticism for the use of abnormally low presentation levels for the subliminal stimuli: between .00053 and .00165 sec.

Dechenne (1976) conducted a study to determine if a task involving psychomotor and problem-solving skills could be taught subliminally to fifth-grade, ninth-grade and upper division college students during the showing of an unrelated videotape. The task was the assembly of a tangram (a set of seven geometric figures which, when correctly assembled, form a square). The figures could also be assembled to form

many other familiar shapes. The fifteen minute videotape was unrelated to the subject matter and did not contain any academic content. Two versions of the videotape were made, one without any subliminal stimuli, the other with subliminal flashes of the step-by-step procedures involved in assembling the tangram. The complete series of slides which showed the puzzle assembly consisted of seven slides, each of which was exposed for .005 second at five-second intervals. When the end of the series was reached, the sequence of slides was repeated. (This amounts to each slide being exposed for a total of .07 sec. and a total exposure time for the entire series of .49 sec.)

Data for the study were collected by giving the subjects (after viewing the videotape) an envelope containing the seven pieces of the tangram. Subjects were given fifteen minutes to assemble the tangram into a square and were scored based on the number of correctly placed pieces.

Dechenne concluded that under the conditions of this study, students were not able to be taught a task, subliminally, involving psychomotor and problem solving skills. This was consistent with Taris (1970). However, Dechenne noted that, although not statistically significant, the experimental groups did achieve better scores than the control groups, which indicates that subliminal stimuli had influenced the subjects. Dechenne also pointed out that the extremely short total exposure time of the subliminal stimuli may have

affected the possibility of learning taking place. It is also possible that Dechenne could have achieved significant results had he presented the completed pattern as the stimulus, rather than the sequence of assembly. Sequence for this task was unimportant and only the final result mattered, but most of the subliminal stimulation was wasted in presenting that sequence.

It should be noted that, in the studies of both Dechenne and Skinner, both researchers claim to have presented the subliminal stimuli at .005 second when played back on a videotape recorder. This is technically impossible on television as the fastest presentation speed would be the speed at which one frame "writes over" the preceding frame. In North America, this occurs at the fixed rate of .033 second (Ennes, 1971, p. 29). One of two possibilities occurred in these studies: either the stimuli were presented at .033 second (the fastest possible speed when using videotape as a presentation medium) or, alternatively, during the recording, when the image was flashed in front of the television camera at .005 second, it coincided with the short blank space (the vertical interval) between frames, and consequently was not recorded at all.

Moore (1983) studied the effects of reinforcing subliminal captions and cognitive style (field dependent/field independent) on the recall of cognitive information presented in a television program. Moore tested four levels

of captioning (subliminal captions, supraliminal captions, a combined treatment and a combined treatment with mismatched captions) against 2 types of cognitive style (field dependent and field independent) with the dependent variable, recall, measured by a multiple choice test. Captions were embedded in an eight-minute television program on ancient architecture. The experimental group consisted of 199 undergraduate students.

The videotapes presented 15 concepts, each of which, in the supraliminal treatment, had a caption superimposed for 5 seconds. The subliminal treatment had captions presented at the speed of one television frame (.033 sec.), 7 times for each concept, equal to an aggregate exposure time for each concept of .231 sec.

Moore found that the method of captioning significantly affected student ability to recall information presented in the tv program. Students receiving the subliminal-only treatment scored significantly lower than those receiving the supraliminal only treatment. However, he found no significant differences in recall among field independents across captioning modes. There was a significant difference among field dependents across captioning modes. Moore also reported that recall scores of field dependents were not significantly different from field independents when shown only subliminal captions. Moore studied the use of captions for instructional television, as opposed to general purpose

educational programming. It is assumed that it was for this reason that he did not include a treatment with no captions at all.

2.3.5 Affective Domain

A recent study by Ledford (1978) was concerned with the effects of subliminal visuals on the affective domain of learners. Ledford projected subliminal stimuli to test groups during otherwise normal classroom procedures. The test groups were presented with subliminal stimuli which consisted of either a drive-related sexual stimulus, a drive-related death stimulus, a neutral stimulus, or no subliminal stimulation at all. Ledford found that the sex-oriented visual subliminal messages made learners willing to submit controlled attention to a prescribed learning task. Projection of the drive-related death stimulus resulted in no significant differences.

Parker (1982) tested the effects of subliminal stimulation of "oneness" fantasies on academic performance of undergraduate university students. In this study, subjects were told that they were receiving subliminal stimulation. Three test groups received one of three different messages: 1) "MOMMY AND I ARE ONE" 2) "MY PROF AND I ARE ONE" or 3) "PEOPLE ARE WALKING" (neutral control group). Subjects attended class daily for 6 weeks, and were treated with subliminal stimulation via tachistoscope on three days of

each week. Stimulation consisted of two brief exposures of the message, 10 seconds apart. Parker found that both experimental groups received significantly higher grades than the control group.

2.4 Summary

Fleming and Levie (1978), Hsia (1968) and Severin (1967a, 1967b) state that perception can be improved when two or more channels of communication (i.e. sound and vision) are used. Severin has pointed out that, in any particular learning situation, as the number of available cues is increased, learning will increase. These principles of multiple-channel communication, as well as research into cueing strategies (Rappaport, 1957; Dwyer, 1972), provide a theoretical base for the use of visual captions in instructional video presentations.

Studies which have found that captions were effective in facilitating learning from television or film were conducted by Kurtz (1950), Northrop (1952), Schwarzwald (1960), McIntyre (cited in Chu & Schramm 1967), Tidhar (1973), Wagner (1974) and Coldevin (1975a, 1975b).

Studies by Miller & Levine (cited in Chu & Schramm 1967) and Miller, Levine & Sternberg (cited in Chu & Schramm 1967) found captions to have no effect on learning from film, but these findings may have been due to the more organized nature of the films which were used. Northrop (1952) has indicated that well-organized films yielded better results without captions, while less-organized films resulted in

more learning when captions were used. One could also apply the principles of Severin's (1967a) cue summation theory to these findings, in that one would assume that a well-organized film, to which reinforcing captions had been added, would then contain redundant cues.

Webster and Cox (1974) found color by itself could not increase the effectiveness of captions, but informing the subjects of the purpose of the color when used for denoting important points in the captions did significantly increase effectiveness.

Many experiments in subliminal perception have used visual captions as subliminal stimuli. These studies provide conflicting results as to the effectiveness of the subliminal messages.

In studying the relationship between subliminal perception and human behavior, Klein, Spence, Holt and Gourevitch (1958) and Smith, Spence and Klein (1959) reported that human behavior could be influenced by subliminal stimulation. Their findings are consistent with numerous other studies reported in Adams (1957), McConnell, Cutler and McNeil (1958), Erikson (1960), Bevan (1964), Dixon (1971, 1981), Erdelyi (1974), Nisbett and Wilson (1977).

Byrne (1959) reported that motivation could be influenced by subliminal stimulation. Similarly, Zuckerman (1960) found that the use of subliminal imperatives could influence

elaborative thinking.

Kolers (1957), Sharp (1959), Murch (1965), Skinner (1969) and Moore (1983) found that performance on a multiple-choice test could be influenced by subliminal stimulation. Their findings, as well as those of Byrne (1959) and Zuckerman (1960), indicate considerable potential for subliminal prompting in a testing or decision-making situation.

Gerard (1960), Tavis (1970) and Dechenne (1976) found no evidence to support the positive effects of subliminal stimuli on learning, although both Tavis and Dechenne's methods of presentation of the subliminal stimuli may have affected their results. Dechenne reported that a subliminally presented task could not be solved by subjects, but he did find that their scores had been influenced by the subliminal stimuli.

Ledford (1978) and Parker (1972) found that the affective domain of learners could be influenced by subliminal stimulation, with a resulting positive effect on academic performance.

Skinner (1969) and Moore (1983) conducted experiments on the effectiveness of embedded subliminal captions in television programs. Both researchers found that subliminal stimulation had influenced the subjects.

The only study discovered by the researcher in which subjects were informed that they were being presented with

subliminal messages was that conducted by Parker (1982). Parker found a significant increase in grade scores for subjects exposed to the subliminal treatment.

Of the studies involved with cognitive learning and problem solving, those in which the supraliminal and subliminal stimuli were in some way related were conducted by Kolers (1957), Sharp (1958), Gerard (1960), Murch (1965) and Moore (1983). Of these studies, only Gerard (1960) did not report that the subliminal stimulus was effective.

Severance and Dyer (1973) found that subliminal messages were ineffective in generating interference in Stroop tests.

While there is no conclusive evidence as to the effectiveness (or ineffectiveness) of subliminal stimulation, results from the available research indicate that, under certain circumstances, human beings are capable of responding to visual messages of which they are not consciously aware.

Factors which may increase the likelihood of response to subliminal stimuli include: a positive relationship between the subliminal and supraliminal stimuli, and the avoidance of stimuli which run counter to established drives, habits, beliefs and knowledge already possessed by subjects.

In applying subliminal research to the study of non-obtrusive captions, the points made above are

strengthened by research into visible captions.

Cueing the subjects as to the existence of the stimulation in the same way as Parker (1982) may also contribute to a positive response. This would be consistent with research into advance organization (Webster and Cox, 1974) and cueing strategies (summarized in Dwyer, 1972).

Chapter 3

HYPOTHESES

3.1 Statement of the Hypotheses

The following hypotheses were formulated:

1. There will be a significant difference in learning between subjects viewing a videotape with visible (supraliminal) reinforcing captions and subjects viewing a videotape with no reinforcing captions.
2. There will be no significant difference in learning between subjects viewing a videotape with non-obtrusive (subliminal) reinforcing captions and subjects viewing a videotape with no reinforcing captions.
3. There will be no significant difference in learning between subjects viewing a videotape with non-obtrusive (subliminal) reinforcing captions and subjects viewing a videotape with visible (supraliminal) reinforcing captions.

3.1.1 Rationale for the Hypotheses

Cue summation theory as expressed by Severin (1967) predicts that learning is increased as the number of available cues or stimuli is increased in the learning situation. He qualifies these cues as having to be both non-redundant and relevant to the learning situation.

In the present study, the visible captions were directly related to the audio-visual content of the videotape. In view of the high level of difficulty of the presented material, Severin's caution against redundant cues (words presented both aurally and in print) did not really apply, as Severin himself makes clear (p.243) and as is supported by Card's (1966) study.

Cue summation theory is also supported by the findings of numerous studies relating to captions and learning from television or film (Kurtz, 1950; Northrop, 1952; McIntyre, 1954; Schwarzwald, 1960; Coldevin, 1975a, 1975b). All of these studies found that learning was enhanced through the use of captions.

Travers (1964) did not find learning any more enhanced through the use of combined audio-visual cueing than the use of visual cueing only, but the relevance of Travers' study to television is questionable. Travers used nonsense syllables as cues and presented them as projected film.

transparencies rather than as video: these two techniques are quite far removed from the reality of television captions. In addition, Travers did find that both audio-visual and visual-only cueing were more effective than audio cueing only.

The use of a unidirectional hypothesis as hypothesis #1 was thus supported by the literature, as a videotape with visible reinforcing captions was expected to have a positive influence on learning when compared to a videotape containing only audio cues (control group). The high degree of probability of this hypothesis proving true also served as a "benchmark" for the study: should this hypothesis prove false any generalizations about the results would be open to the criticism that the captions themselves were flawed.

Null hypotheses were formulated for hypotheses #2 and #3 because, although the existence of subliminal perception as a phenomenon now seems to be an accepted fact (cf. Dixon, 1971), the question of whether or not subliminal stimulation can be utilized to enhance learning has not been treated adequately.

Gerard (1960) and Dechenne (1976) concluded that, although students could be influenced by subliminal messages, learning did not occur. Dechenne's study, however, is not wholly conclusive because of the fragmentation of the complete message and the unknown presentation speed of the stimulation. Kolers (1957), Sharp (1959) and Murch (1965)

studied the effects of the subliminal presentation of answers to tests. All reported that students' responses were improved by the subliminal stimulation.

Skinner (1969) found that student vocabularies could be improved through subliminal stimulation, and also found evidence to support the equivalence of subliminal and supraliminal captions in enhancing vocabulary learning. Skinner used captions wholly unrelated to the audio-visual content of the videotapes which he presented, but this does not contradict Severin's (1967) conclusions: Skinner's results are not based on differing levels of cue-relatedness.

Severance and Dyer (1973) demonstrated the failure of subliminal words to cause interference in a Stroop test. While shedding light on the relative strength of subliminal messages when in competition with, rather than reinforcing visible stimulation, the study did not, as is suggested by Moore (unpublished), prove that the meaning of subliminal messages cannot be processed by the viewer.

The implications of cue-summation theory suggest that if subliminal stimuli were related to the subject matter of a videotape they should be even more effective. Studies such as those conducted by Kolers (1957), Klein, Spence, Holt & Gourevitch (1958), Sharp (1958), Smith, Spence & Klein (1959), Murch (1960) and Moore (1983) have used related stimuli and have reported significant effects.

It is one thing, however, to have an effect, and quite another to actually enhance learning. The results of the above studies indicate that, if not probable, then it is at least possible that subliminal or non-obtrusive captions could help students to learn from a videotape in much the same way, and perhaps to the same degree, as supraliminal or visible captions.

Because of the high order of skepticism surrounding subliminal stimulus research and the conflicting evidence of a number of studies, null hypotheses are supported for hypotheses #2 and #3.

3.2 Operational Definitions

The variables used in this study and the definitions applied to them are as follows:

3.2.1 Independent Variable

Reinforcing captions, with three levels being compared: non-obtrusive (subliminal) captions, visible (supraliminal) captions and no captions. In this study, the term "reinforcing captions" refers to printed messages which sum up or repeat concepts presented in either the aural or visual channel of a videotape.

Non-Obtrusive Captions: Captions which have been superimposed onto a videotape and are presented for .033 second at low intensity so as to be so faint that they are below a viewer's level of conscious awareness.

Visible Captions: Captions which have been superimposed onto a videotape and are presented at the conscious level of the viewer's visual perception.

3.2.2 Dependent Variable

Effectiveness, as measured by test performance on a knowledge recall multiple choice test.

3.2.3 Control Variables

Age, Sex, Educational Level and Socioeconomic Status were controlled by the randomization of 3 Grade 11 classes from the same public high school in the city of Laval, a suburb of Montreal.

3.3 Operational Restatement of Hypotheses

Grade 11 students who viewed an educational videotape which had concepts summed up in the form of messages presented at a conscious level of visual perception were expected to achieve the same scores (except for chance differences) on a knowledge-recall test, as students who viewed the same videotape, but had no messages presented at all.

Both of these groups of students, when compared with other Grade 11 students from the same high school who viewed a videotape identical in content, but with messages presented at a subconscious level of visual perception, were expected to achieve essentially identical scores, except for chance differences, on the same knowledge-recall test.

Chapter 4

RESEARCH METHODOLOGY

4.1 Sample

The experimental population consisted of 58 anglophone students attending Chomedey High School in the city of Laval. All subjects were drawn from three "Man and Society" classes comprised of both Secondary Four and Five levels (age group: 16-17 yrs). Socioeconomic status for this population was mixed middle-class and working-class ethnic communities.

Selection bias was controlled by randomly assigning subjects to three experimental groups.

4.2 Design

4.2.1 Experimental Design

A randomized posttest-only control group design with one independent variable containing three levels was used:

R	X1	01
R	X2	02
R	X0	03

No pretest was required due to randomization of the subjects. This randomized design (after Tuckman, 1972) controls for all threats to invalidity or sources of bias. The posttest was applied immediately following the treatment.

4.2.2 Treatment Conditions

X1: Embedded non-obtrusive (subliminal) reinforcing captions were presented in the videotape. Sixteen captions were presented at a speed of .033 sec. and at a brightness level of 40% as measured on a video waveform monitor. Level of brightness was determined in the pilot study. The captions were each presented once per second for 15 consecutive seconds, for an aggregate time of .5 seconds per concept.

X2: Sixteen visible (supraliminal) reinforcing captions were presented with the videotape. During each concept segment,

one visible caption was continuously superimposed for 15 consecutive seconds over the videotape picture. No other captions of any type appeared in each segment. This treatment represented conventional visible captioning methods used in instructional television.

X0: (Control Group) The videotape alone, with no reinforcing captions of any kind. The control group served as a comparator against which to judge the relative effectiveness of captioning treatments.

4.3 INSTRUMENTATION

4.3.1 PILOT STUDY

A pilot study, strictly concerned with the practical validation of the non-obtrusive treatment, was carried out with 13 subjects. Subjects comprised a mix of anglophone students and employees of Concordia University in Montreal. Age level varied from 22-32 years.

The videotape used for the pilot study consisted of six identical 2.5 minute segments from the original experimental tape. The subjects were shown the videotape on an individual basis.

Each segment had non-obtrusive captions superimposed at a constant speed of .033/sec., but at different brightness levels for each segment. Brightness levels of the captions were classified as 30%, 40%, 50%, 60%, 70%, 80%, each relating to the degree of luminance of the captions, as measured on a Tektronix video waveform monitor. The video picture onto which the captions were superimposed contained luminance levels up to 110%.

Subjects were informed of the presence of the captioning stimulation, but not of its content. The video segment was an animated sequence of the interior of the brain. The same

four captions were presented during each segment. The captions used were: "COMMUNICATION PATHS", "NEURON", "EXCITATORY/INHIBITORY", "NEUROTRANSMITTERS".

For each segment, subjects were asked to note if they found any disturbing flashes in the picture and to write down any words which they thought might have been superimposed.

Results of the pilot study revealed that, at the 50% level of luminance and higher, some subjects were able to correctly identify some of the captions. At the 30% luminance level, 85% of the subjects were unable to report any flashing on the screen.

At the 40% luminance level, most of the subjects could report the flashing, although none could identify any of the words. Thus it was determined that the 40% level was the most likely to produce positive results in studying the effectiveness of non-obtrusive captions.

4.3.2 POST-TEST

Test performance was assessed by means of a 22-item multiple-choice knowledge recall quiz administered directly following the videotape presentation (see Appendix B).

Of the 22 questions, 16 were directly related to the superimposed reinforcing captions (see Appendix C). The remaining six questions served as distractors, although they were pertinent to the viewed material. The questions were

validated by the teachers responsible for the students and were judged to be difficult, but within the capabilities of the students.

4.4 Materials

4.4.1 Television Presentation

The television program used for the study was an edited version of a National Geographic Society presentation: "Mysteries of the Mind". Originally a 60 minute program, the edited version was created in order to allow for both presentation and testing within a 50 minute class period. The edited program had a running time of 23 minutes.

Concepts presented by the program were considered by the program producers to be suitable for a general audience, age 14 and up.

The program began with the presentation of a number of mind-related "mysteries" such as the ability of a man to lie on a bed of nails, how another man can shatter bricks with his hand and how a violinist can remember the playing order of over 6000 notes.

This was followed by a short introduction to the role of the brain, our understanding of its physical qualities and our attempts to comprehend the human mind. More examples of the power of the mind were given and the parts of the brain were outlined using animation techniques.

The concept of pain and pleasure centres within the brain

was explained through a "brain reward" experiment with a rat. Another experiment, this time with a human, illustrated the dual hemispheres of the brain and their functions in everyday life.

The concepts of dreaming and "rapid eye movements" were presented, followed by a case of narcolepsy (inability to stay awake). Narcolepsy was shown to be a physical problem which affects animals as well as humans.

Hypnosis was shown to produce anaesthetic conditions in humans. Alert self-hypnosis was related to the well-known "second wind" of athletes.

An example was given of the power of meditation, in which an Indian yogi slowed down his breathing to a point which allowed him to survive for a long period of time in a near oxygen-less atmosphere.

The concepts which were presented in the videotape were visually recapitulated in the closing of the program.

The original program did not use captions to present information, other than for the opening titles and closing credits, therefore there was no interference from redundant captioning techniques.

4.4.2 Preparation of Television Presentation

The television studio facilities of the Audio Visual Department of Concordia University were utilized in order to create the edited program. The 16 captions used in the study were created on a Kaypro computer and converted to video through an A.B. Dick character generator. Appendix C contains a list of the captions.

All captions were in uppercase only. Both non-obtrusive and visible captions were superimposed in the same location onto the video image via a Ross downstream keyer. Examples of the superimposed visible captions are presented in Appendix D. Brightness levels were determined through a Tektronix waveform monitor. An electronic switching unit was constructed which allowed consistent timing of the subliminal presentation speed of .033 sec.

Three 30 minute, 3/4" videotapes were required to assemble the individual treatments. These three finished videotapes were then copied to three more 3/4" tapes. The copies were used for the treatments.

4.5 Procedure

4.5.1 Selection of Sample

In consultation with school administrators and class teachers, three senior classes of the "Man and Society" option course were selected for the study. These classes were selected for the relevance of the videotape content to the course. Discussion with the teachers determined that each class represented a cross-section of the students in the school, with even mixtures of "high", "regular" and "low" achievers.

Random selection of the three treatment groups was carried out as follows. The names of all the students from the three classes were entered into a common pool and alphabetized. There were a total of 92 names in the common pool. The names were then numbered from 1-92. Numbers were then drawn from a random number table (Tuckman, 1972, p. 368-9.), matched with a subject-number and assigned to the first group until 31 subjects were assigned. This procedure was reapplied to the second group. The final group of 30 subjects were the remainder. The three groups were then arbitrarily assigned to one of the three treatments.

On the day before the experiment, subjects were told that the next day, after home-room, they would be assigned to a

classroom where they should report. Subjects were aware that they would be part of a study being conducted by a student at Concordia University, but not of the nature of the experiment.

On the day of the experiment this procedure was followed exactly and the students reported promptly to the assigned rooms. However an unexpected complication sharply reduced the number of subjects participating in the study. Absenteeism at the school was inordinately high: the result being three treatment groups with a total number of subjects equal to 58.

4.5.2 Physical Setting of the Study

In order to control treatment variables, all groups were exposed to the stimulus materials simultaneously and under very similar conditions. The three classrooms used for the treatments were standard size classrooms. All had heavy curtains which were drawn in order to make the video picture as clear and bright as possible and to control reflections which might have impaired the view of some subjects. Overhead fluorescent lighting was turned off during the video presentation. The classroom seating was arranged in a horseshoe shape facing inwards. Two television monitors were set up at the open end of the horseshoe, angled at approximately 120 degrees to each other. Viewing distance of the farthest seat to a television monitor was

approximately 12 feet, that of the closest seat being approximately 7 feet.

4.5.3 Equipment

Each classroom designated for a treatment group was outfitted with identical playback equipment for the presentation. This equipment consisted of two Sony 17" diagonal color television receiver/monitors and one Sony 3/4" U-Matic videotape recorder/playback unit. The television monitors were placed on roll-around equipment carts which raised the bottom of each monitor to a height of 4 feet above the level of the floor.

4.5.4 Procedure

Each treatment group was assigned a research assistant who supervised the group, presented the treatment and conducted the post-test. The class teacher assisted in the discussion period which followed the post-test.

The treatment groups assembled between 8:00 and 8:04 A.M. The research assistant began the introduction to the treatment at exactly 8:04 following the timetable indicated below.

CLOCK	LENGTH (MIN)	ACTIVITY
08:04:00	3	Class comes into classroom, general introduction.
08:07:00	23	Videotape is shown to students. Quiz distributed at end of tape.
08:30:00	1	Quiz begins, Instructions.
08:31:00	11	Students told to begin quiz.
08:42:00	1	Collection of quiz.
08:43:00	11	Discussion of experiment.
08:54:00		Class dismissed.

The following general introduction was given to all treatment groups.

This is an experiment being carried out on learning from television. It is part of a thesis in Educational Technology at Concordia University. We are testing students from three "Man and Society" classes and your participation is very important to the final results.

What will happen today is that you will watch a videotape produced by the National Geographic Society and titled THE MYSTERIES OF THE MIND. All three of the classes will see the videotape. It is important that you pay attention to the tape as it is played, and to do your best on the quiz which follows. The quiz is multiple choice, some of the questions are quite difficult, but if you pay attention to the videotape, you should do quite well.

One thing you should remember is that when you do start the quiz, you will not have until the end of the period to complete it. I will be timing the quiz and it will only last for 11 minutes, so don't waste time.

The watching of the videotape is as much a part of the experiment as the quiz, so please clear your desks of books and papers. There is to be no notetaking and no talking during the showing of the tape or during the quiz.

We will have a discussion period at the end of the quiz in which I will be explaining all about the nature of the experiment and what we expect to see from the results.

Any questions?

At this point (3 minutes into the class) the videotape was started and the room darkened. The videotape was shown in its entirety, including credits. After the videotape was shown, room lights were again turned on, the post-test was distributed face down, instructions reiterated and the students told to start the quiz. At the end of the test period (8:42 on the clock) the post-test was collected and a discussion ensued. The treatment groups were dismissed at 8:54 A.M.

Chapter 5

RESULTS

5.1 Group Randomness

Group randomness was verified through analysis of treatment group sex types. The distribution of sex types can be seen in Table 1. Distribution remained even throughout the groups when compared with the ratio of sex types in the common pool of subjects from which the treatment groups were drawn.

Table 1

SEX TYPE DISTRIBUTION

MALE	45%	47%	42%	45%
FEMALE	55%	53%	58%	55%
N	22	19	17	58
	TREATMENT 1	TREATMENT 2	TREATMENT 3	COMMON POOL

5.2 Observations

Observations recorded by research assistants during application of the post-test were:

Treatment 1: -4 subjects did not pay close attention to the
(X1) tv.
(n=22) -2 subjects did not have adequate time to complete the post-test.

Treatment 2: -2 subjects did not pay close attention to the
(X2) tv.
(n=19) -1 subject did not have adequate time to complete the post-test.

Treatment 3: -1 subject did not pay close attention to the
(X0) tv.
(n=17)

On completion of the post-test, subjects in treatment group X1 were asked if they had seen any of the captions. No subjects reported having observed them, or of noticing any flashing on the screen.

5.3 Primary Analysis

5.3.1 Hypotheses

The purpose of this study was to determine the relative effectiveness of inserted non-obtrusive and visible reinforcing captions in a video program. The following hypotheses were tested:

1. The visible captions treatment group (X2) will perform better than the control group (X0).
2. The non-obtrusive captions treatment group (X1) will perform in an equal fashion to the control group (X0).
3. The non-obtrusive captions treatment group (X1) will perform in an equal fashion to the visible captions treatment group (X2).

5.3.2 Test Reliability

Test reliability was assessed through the method of rational equivalence. The Kuder-Richardson test for internal consistency, K-R formula 20, was applied to the dichotomous scores on two levels: $r(k-r/20) = .38$ was obtained for the

test as a whole (22 questions), and $r(k-r/20) = .25$ was obtained for the caption-prompted questions (16 questions).

The extremely low values for r which were obtained indicated that the test-items on the post-test were not homogeneous and were not producing similar patterns of response in different subjects. However, observations indicated that a number of subjects from each treatment group did not pay close attention to the videotape and that some subjects did not have enough time to complete the post-test, thus effectively reducing N , which had already been seriously depleted due to absenteeism. In addition, three different treatments were involved and the test measured prompted recall based on these treatments. A low degree of internal consistency was not considered reason enough to discontinue analysis of the scores.

5.3.3 Analysis of Variance

A one-way analysis of variance with 3 independent variable levels was applied to the raw scores on the post-test in order to test for the differential effects of captioning treatments on test performance (Table 2).

The obtained F -ratio of .240 was not significant. This indicated that any differences between performance of the treatment groups could not be attributed to the treatments.

The large within-group mean square indicated that a large variation of performance level existed within each treatment group.

As a consequence, Hypothesis #1 was rejected and Null Hypotheses #2 and #3 were accepted.

Table 2
ANALYSIS OF VARIANCE

SOURCE OF VARIATION	SS	df	MEAN SQUARE	F
Between Groups	3.5	2	1.7	.24
Within Groups	401.4	55	7.3	
Total	404.9	57		

Table 3
MEAN SCORES

	TREATMENT			TOTAL
	X1 NON-OBTRUSIVE	X2 VISIBLE	X0 CONTROL	
n	22	19	17	58
<u>ALL QUESTIONS</u>				
MEAN	8.7	9.2	8.6	8.8
SD	2.3	3.4	2.3	
# of Questions	22	22	22	22
<u>CAPTION-PROMPTED QUESTIONS ONLY</u>				
MEAN	6.7	7.8	7.1	7.2
SD	2.1	2.4	1.7	
# of Questions	16	16	16	16

Chapter 6

CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

6.1 Conclusions and Discussion

The purpose of this study was to assess the effectiveness of the superimposition of non-obtrusive (subliminal) reinforcing captions into an instructional videotape in order to facilitate learning at the senior high school level. A multiple-choice knowledge-recall test was developed to measure learning achievement. A 23-minute videotape presentation on the human mind was edited by the investigator from a 60 minute program produced by The National Geographic Society entitled "The Mysteries of the Mind". Three treatment groups were assembled: one group viewed the videotape with inserted non-obtrusive captions, while another group viewed the videotape with inserted visible captions. The control group viewed the videotape with no captions presented at all.

The discussion and conclusions in this chapter are organized under the re-examination of each hypothesis in relation to the obtained results.

6.1.1 Initial Characteristics of Groups

After randomization and selection of treatment groups, randomness was verified through comparison of control variable equivalence (Tuckman, 1972). Distribution of sex-types was analyzed across treatment groups and compared to the common pool of subjects from which the groups were drawn. Analysis revealed that distribution remained even. It was concluded that a) randomness had been achieved and b) the three treatment groups could be considered equivalent.

6.1.2 Hypothesis #1

There will be a significant difference in learning between subjects viewing a videotape with visible (supraliminal) reinforcing captions and subjects viewing a videotape with no reinforcing captions.

The results show that students who viewed the videotape with visible captions did not perform better on the post-test than students who viewed the videotape without any captions. Hypothesis #1 cannot be accepted.

This finding differs from the majority of research on captioning treatments. Studies by Kurtz (1950), McIntyre (cited in Chu & Schramm, 1967), Schwarzwald (1960), Tidhar (1973), Coldevin (1973a, 1973b) have all shown that visible

captions have a positive influence on learning.

One possible explanation for this anomalous finding is that interference occurred between the visual and auditory channels. In this study, the visible captions were directly related to the audio-visual content of the videotape. According to multiple-channel communication theory (Dwyer, 1978; Fleming and Levie, 1978), perceptual capacity should be improved when employing more than one channel to communicate. The lack of significant effects in this study is contradictory to the findings of Travers (1964), who found that combined audio-visual cues were significantly more effective than audio cues only. Travers' results, however, were based on nonsense syllable cues which were totally unrelated to any stimulation. The use of directly related visible captions in this study should have prevented the interference proposed by Severin (1967a, 1967b) and demonstrated by Hartman (1961) when using unrelated information across channels.

Severin (1967a, 1967b) also warned against the simultaneous use of redundant words in both aural and print channels. In this study, the visible captions were the same words as were spoken by the narrator and so may have been contributors to interference rather than improvement. However, the validity of this explanation is questionable as the spoken words relating to any given caption required no longer than 2.5 seconds for the narrator to speak them. Any interference

generated by the overlap of 2.5 seconds seems sure to be outweighed by the remaining 12.5 seconds of related, not redundant, captioning.

Neither is the issue of redundant cues absolutely clear. Card (1966) found that redundancy could be beneficial and, consistent with Card, Severin specified that if the material presented is difficult, then a combined audio-visual presentation should produce better results than visual alone. The level of difficulty was indeed high for the subjects, as can be seen in the low mean scores for the treatment groups. The very low obtained r 's and the high within-group variance also demonstrate that, for a good portion of the students, the post-test was quite difficult.

The findings of this study are in agreement with those of Miller & Levine and Miller, Levine & Sternberg (both cited in Chu & Schramm, 1967) who found no significant differences in versions of a film with and without captions. Northrop's (1952) findings suggested that captions improved performance when used with less organized films and that there was no effect when used with simple and well-organized films. This reasoning may well be applied to the results of this study: one could label the video presentation as well-organized and straight-forward. But there are numerous reasons for not doing so. The presentation was produced for mass broadcasting; consequently it contained many irrelevant, but entertaining, segments which contributed nothing to its

educational simplicity and organization. Also, the fact that students found the post-test quite difficult, when in fact it was a simple test of knowledge recall, seems to indicate that the initial presentation of the concepts was not clear or well-organized.

One important point raised by both the Kuder-Richardson r 's and the large variance within each treatment group is the validity of making any generalized inferences from the scores of students with such wildly differing performances. The use of the F -ratio assumes relatively equivalent performances from students within a single group and F becomes insignificant as within-group differences grow. This within-group variance of ability was confirmed through interviews with the teachers of the subjects. The school board policy of integrating students of mixed academic abilities into single classes has apparently resulted in seriously mismatched class make-up. There is also a high percentage of students in the school with language problems. For a great number of them, English is a second language. This problem is much in evidence at the school from which the sample was drawn: teachers are having a difficult time teaching classes with any form of uniform progression as slow students and poor readers slow down the bright students.

The precision of the results of the statistical analysis for this study is also limited due to the low N on the day of

testing. A further effective reduction of N occurred when it was observed that a few students in each treatment group were not paying close attention to the videotape while it was playing.

Despite the lack of significant results found for this hypothesis, it should be noted that the mean score of the visible caption group (9.16) was higher than the mean score of the control group (8.59). Therefore there is a slight indication that the treatment group with visible captions did in fact perform better than the control group. This would be in line with other research on captioning.

6.1.3 Hypothesis #2

There will be no significant difference in learning between subjects viewing a videotape with non-obtrusive (subliminal) reinforcing captions and subjects viewing a videotape with no reinforcing captions.

The results confirmed Hypothesis #2 in that students who viewed the videotape with non-obtrusive captions did not perform any better or worse on the post-test than students who viewed the videotape with no captions. Hypothesis #2 was, therefore, accepted.

In the discussion of Hypothesis #1 several arguments were advanced as to why the visible captions used in this study

did not promote improved performance. These included: 1) interference inherent in multi-channel communication when related or redundant cues are provided, 2) level of difficulty of presented material, 3) large variation in student ability within treatment groups and 4) limited sensitivity of the statistical analysis due to the small sample population. Overall learning was quite low (average score for the three treatment groups was 8.8 out of a possible total of 22). This indicated that the task was too difficult for the students and is confirmed by the low obtained r values. The post-test may not have been a sensitive enough instrument to measure the effects of visible captions. This being the case, it is unlikely that it would be sensitive enough to measure the effects of non-obtrusive captions. These arguments help to explain the lack of effects from non-obtrusive captions and the relative equivalence of the two group means.

7

6.1.4 Hypothesis #3

There will be no significant difference in learning between subjects viewing a videotape with non-obtrusive (subliminal) reinforcing captions and subjects viewing a videotape with visible (supraliminal) reinforcing captions.

The results demonstrated that students who viewed the videotape with non-obtrusive captions performed as well on

the post-test as students who viewed the videotape with visible captions. Consequently, Hypothesis #3 was accepted.

Skinner (1969) found no differences between subliminal captions and supraliminal captions, but with an important difference: both groups performed better than the control group. In this study there were no differences among all three groups.

Discussion of Hypotheses # 1 and #2 resulted in a number of conclusions as to the ineffectiveness of both non-obtrusive and visible captioning treatments over no captioning treatment. In comparing the effectiveness of one treatment against the other these conclusions point to an expected difference between these two groups. If multi-channel interference occurred, it would have affected both treatment groups, as the captions were identical except for their level of visibility, or speed of presentation. But if speed of presentation was the determining factor, then, following the studies of Smith and Henriksson (1955), Paul and Fisher (1959), Zuckerman (1960), Spence and Holland (1962) and Zwosta and Zenhausern (1969), there would have been some expectation that the non-obtrusive captions treatment group perform less well on the post-test than the visible captions treatment group. This was not the case.

The results of this study indicate that non-obtrusive reinforcing captions have no significant effect on

performance on a knowledge recall test when inserted into a videotape presentation. However, this conclusion is problematic due to the lack of any significant differences between presentation of non-obtrusive captions, visible captions and no captions at all. Evidence from numerous studies suggests that this would not have been the expected result. Certainly the wide variation in student ability and the small sample size contributed to a testing situation unsuitable for precise statistical analysis. Examination of the mean scores of the three treatment groups (Table 3) yields an overall impression of the effects, but the differences are not statistically significant. The visible captions group (9.16) did score higher than both remaining groups, and therefore there is a slight suggestion in the evidence acquired that one could also say that the non-obtrusive captions group (8.68) performed better than the control group (8.59).

6.2 Recommendations for Future Research

The inconclusive results of this study invite further research in the areas outlined below.

1. It would be useful to assess the relative

effectiveness of visible captions paired with different types of video presentations, such as educational and entertainment programs. Following the lead of Northrop (1952) further research should also be conducted into the organization of captioned video programs.

2. More research is needed in the area of multi-channel interference and redundancy. Hartman (1961) has stated that the level of difficulty in each channel must be such that it permits the learner to switch attention between an audio message, a visual-pictorial message and a visual-printed message, and then to assess the optimal redundancy level between channels.
3. Future studies in this area should pay close attention to large differences in student general aptitude through extensive pre-testing (especially of reading and comprehension ability) and the level of difficulty of the post-test should be carefully examined through pilot tests and matched to student ability. These studies should ensure a large sample size, as non-obtrusive captions may have a very faint effect which may be observable only with large groups.
4. A longitudinal study should be conducted. The effects of non-obtrusive captions may be very slight and could show up over time, in a fashion similar to that found by Rarker (1982). A long term study would also reduce

the novelty effects often found in captioning studies.

5. Research should be conducted on the speed of presentation of non-obtrusive, or subliminal, captions and its relation to the effort of reality contact. It may be that this research could obviate the need for any further research into subliminal-type captions on videotape by showing that the video frame rate is too slow for the captions to be effective.

Certainly this study has not provided any conclusive evidence regarding the efficacy of non-obtrusive captions. Rather, it has added to the already large body of conflicting and confusing research surrounding subliminal messages. There remain a number of questions regarding the many facets of video captions and learning which should be investigated.

Chapter 7

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Appendix A

DEFINITION OF TERMS

Captions: words which are superimposed on a video or film picture and which provide the viewer with additional identifying or explanatory information.

Reinforcing Captions: captions which make particular reference (either word for word or in part) to visual and/or aural information presented previously or simultaneously during a video or film presentation.

Subliminal: visual information presented at a speed and/or intensity that is below the conscious threshold and thus not readily apparent. Subliminal stimuli cannot be consciously discriminated under the conditions of the experiment, but are not too weak to be influential on the conscious process. (English & English, 1958, p.531)

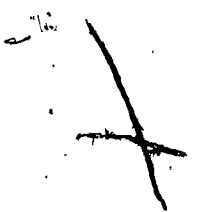
Subliminal Perception: a reaction to a stimulus, manifested by a behavioral response, when the stimulation is presented below the threshold of conscious awareness.

Supraliminal: visual information presented at a speed and/or intensity that is above the conscious threshold and easily

visible to the viewer.

Threshold: the point below which visual perception is subconscious and above which visual perception is conscious.

Non-Obtrusive Captions: captions which are presented at a speed and/or intensity that approximates subliminal presentation. Under the conditions of the experiment, at least 50% of the viewers cannot consciously discriminate non-obtrusive captions.



Appendix B

POST-TEST

"THE MYSTERIES OF THE MIND"

NAME: _____

CIRCLE THE CORRECT ANSWER FOR EACH QUESTION.

1. The human brain consumes _____ of total oxygen intake.
 - 1) 35%
 - 2) 75%
 - 3) 25%
 - 4) 15%
 - 5) 50%
2. The most primitive part of the brain is _____.
 - 1) the cortex.
 - 2) the reptilian brain.
 - 3) the old mammalian brain.
 - 4) the limbic system.
 - 5) the neo-cortex.
3. The reptilian brain is responsible for _____.
 - 1) body movement.
 - 2) instincts.
 - 3) reproductive functions.
 - 4) preservation of life.
 - 5) none of the above.
4. The old mammalian brain is also known as the _____.
 - 1) limbic system.
 - 2) speech system.
 - 3) autonomic nervous system.
 - 4) muscle control center.
 - 5) left hemisphere.

5. The limbic system surrounds the _____.
1) cortex.
2) neo-cortex.
3) reptilian brain.
4) old mammalian brain.
5) new mammalian brain.
6. The new mammalian brain is associated with _____.
1) emotion and sexual drives.
2) preservation of life.
3) memory.
4) speech and abstract thought.
5) logic and mathematical functions.
7. The neo-cortex crowns the _____.
1) new mammalian brain.
2) cortex.
3) old mammalian brain.
4) all of the above.
5) none of the above.
8. Within the brain, axons and dendrites are _____.
1) neuralgia.
2) neurotransmitters.
3) synapses.
4) communication paths.
5) none of the above.
9. A nerve cell in the brain is called _____.
1) a neuron.
2) a synapse.
3) a dendrite.
4) an axon.
5) a neurotransmitter.
10. The two signals transmitted in the brain are _____.
1) excretory/involuntary.
2) expository/interdisciplinary.
3) exploratory/intermediary.
4) excitatory/inhibitory.
5) explanatory/inflammatory.
11. Brain signals are also known as _____.
1) synapses.
2) neurons.
3) neurotransmitters.
4) axons.
5) dendrites.

12. _____ is the most complex form of matter in the known universe.

- 1) the human mind.
- 2) the molecule.
- 3) the human brain.
- 4) the synapse.
- 5) the neuron.

13. James Olds' experiments with rats dealt with the stimulation of _____.

- 1) pain centers in the brain.
- 2) hunger centers in the brain.
- 3) training centers in the brain.
- 4) learning centers in the brain.
- 5) pleasure centers in the brain.

14. The primary function of the left hemisphere of the human brain is _____.

- 1) learning.
- 2) language.
- 3) control of all physical functions.
- 4) regulation of all emotions.
- 5) all of the above.

15. The left side of the brain is associated with _____.

- 1) logic
- 2) perception.
- 3) emotion.
- 4) abstraction.
- 5) all of the above.

16. The right hemisphere of the brain is _____.

- 1) the main source of mathematical thinking.
- 2) the main source of analytical thinking.
- 3) the main source of man's evolution.
- 4) the main source of concepts of form and space.
- 5) all of the above.

17. Narcoleptic attacks are triggered by _____.

- 1) loss of muscle control.
- 2) extreme fatigue.
- 3) emotions.
- 4) inbreeding.
- 5) none of the above.

18. A possible cure for narcolepsy is _____.

- 1) hospitalization.
- 2) excitation of the brain.
- 3) no known cure.
- 4) bedrest.
- 5) severing of the two hemispheres of the brain.

19. Narcolepsy is _____.

- 1) excessive sleepiness.
- 2) genetically linked.
- 3) a loss of muscle control.
- 4) a & c.
- 5) a, b & c.

20. An athlete's "second wind" is related to _____.

- 1) runner's hypnosis.
- 2) fatigue.
- 3) proper diet.
- 4) alert hypnosis.
- 5) muscle tone.

21. Experiments with meditation have shown that _____
can be consciously controlled.

- 1) pain.
- 2) the autonomic nervous system.
- 3) the mind.
- 4) the body.
- 5) the musculo-skeletal system.

22. The weight of an adult human brain is about _____.

- 1) 1.6 lbs.
- 2) 3 lbs.
- 3) 4.2 lbs.
- 4) 28 ozs.
- 5) 2 kilograms



Appendix C

CAPTIONS AND RELATION TO POST-TEST QUESTIONS

QUESTION	ANSWER	RELATED CAPTION
1	3	*****NONE*****
2	2	*****NONE*****
3	4	Preservation of Life
4	1	Limbic System
5	3	*****NONE*****
6	4	Speech/Thought
7	3	*****NONE*****
8	4	Communication Paths
9	1	Neuron
10	4	Excitatory/Inhibitory
11	3	Neurotransmitters
12	3	The Human Brain
13	5	Pleasure Centers
14	2	Left Side/Language
15	1	*****NONE*****
16	4	Right Side/Form and Space
17	3	Emotions
18	3	No Cure
19	5	*****NONE*****
20	4	Alert Hypnosis
21	2	Autonomic Nervous System
22	2	Weight-3lbs

Appendix D

SUPERIMPOSED VISIBLE CAPTIONS

