THE EFFECTS OF PERCEPTUAL TYPE AND PRESENTATION
MODE IN A VISUAL LOCATION TASK,

by

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Chapter 1

INTRODUCTION

In recent years the field of educational media has developed beyond the stages of attempting to show a relative global superiority of one medium or mode of presentation over another. Researchers in the media field have begun to develop a solid empirical base which considers the interaction of the components of unique medium-message characteristics, psychological requirements of the learning task, and learner characteristics. Researchers have investigated the existence of perceptual types as theorized by Lowenfeld and others. Studies have also related the existence of perceptual types to the teaching of art (McWhinnie, 1970). However, little attention of the Haptic-Visual theory has been directed to the implications for the design of visuals in instructional media.

The term perceptual orientation has been used in education and psychology to denote the specific manner in which an individual functions in the perceptual process of gathering and handling information from his environment (Attneave, 1969). Implicit in the term is the concept of individual style of perception, which research has shown to be of major significance in the understanding of intellectual and psychological functioning. Lowenfeld (1939, 1945) reported extensive research which demonstrated the existence of a typological classification for individuals who vary with respect to their psychological orientation toward sensory perception, or perceptual type. This Haptic-Visual theory identified two extremes

of perceptual types. The extreme Haptic type of person is a normal-sighted individual who uses his eyes only when he is compelled to do so; otherwise he reacts as would a blind person who is entirely dependent on touch and kinesthesia. An extreme Visual person is one who depends entirely on his visual experiences of the environment and would be totally lost in the dark. Most persons fall between these two extremes. A tendency toward visual-mindedness does not mean total reliance on optical perception; it does indicate that impressions coming from the other senses are usually subordinate to those which come from the eye. The Haptic individual is more concerned with feelings and sensations within the individual than with objects sighted in the environment. The Haptic type therefore refers more to such subjective feelings as body feelings, muscle sensations, or kinesthetic experience. The Visual perceptual type tends to transform kinesthetic and tactile experience into visual ones; the Haptic perceptual type does not (Lowenfeld and Brittain, 1970).

A principal distinction between Visuals and Haptics is that Visuals can mentally retain visual imagery while Haptics cannot (Lowenfeld, 1945). This lack of ability of the Haptic individual to hold visual images mentally and to make quick mental note of visual cues suggests that he may have considerable difficulty with certain types of visual learning tasks. It also suggests the potential relationship to the simultaneity of multiple imagery.

In multiple imagery, the simultaneous presentation of separate images, there is a reduced need for the mental retention of visual

images. As all necessary information can be viewed simultaneously, image retention is necessary only for the small amount of time required to shift ones eyes and attention from image to image. In a linear image presentation, the sequential presentation of separate images, a visual image and its details and relationships would have to be retained mentally by the viewer from image to image.

It seems reasonable to expect that simultaneous multiple images used in a task requiring comprehension, retention, and utilization of visual cues might accomplish a theoretical process known as supplantation. This phenomenon occurs when a mental process is executed explicitly for a learner which he is unable to perform for himself (Salomon, 1970), such as mental image retention for Haptics.

Need for the Study

The use of visual presentations in higher education has steadily increased as the field of instructional media has evolved. Early studies of instructional media centered around the attempts to determine the superiority of and student attitude toward specific techniques and modes of instruction. These studies produced inconclusive results. In recent years the field of instructional media has begun to develop an empirical base which combines the unique medium characteristics and psychological requirements of specific learning tasks (Allen, 1975). The existing empirical base is lacking with respect to multiple imagery, perceptual types, and visual location tasks.

The typical format of visual image presentations has consistently

been linear, ie., sequential (Allen, 1974; Fradkin, 1974). Since Haptic individuals have difficulty in mental retention from image to image (Lowenfeld, 1945), the linear format of visual presentations is logically inappropriate. Hence, it would appear that the format of large amounts of the existing visual material would not be effective for Haptic individuals. If the use of multiple imagery enhances the ability for the Haptic individual to learn visual tasks, then the design of instructional media can be made beneficial for Haptics. Since the Visual individual has the ability to retain visual images mentally (Lowenfeld, 1945), multiple imagery may not result in significantly different performance than linear imagery in a visual location task. However, it would seem reasonable to expect that multiple imagery would reduce the visual task factor (Schlanger, 1966), for Visuals as well as for Haptics. If data can be produced which supports the conceptualization that for certain learning tasks and certain perceptual types, a specific format is effective, then instructional developers would be able to utilize the results in media design.

Purpose of the Study

The purpose of the study was to determine the effects of multiple and linear imagery on performance in a visual location task. The study also considered whether the scores in a visual location task were affected by the interaction of presentation mode (multiple and linear imagery) and perceptual type (Haptic and Visual).

Statement of Hypotheses

In order to answer questions concerning the effects of perceptual type and presentation mode, the following hypotheses were formulated:

H₀₁: There is no difference between Visuals and Haptics in a visual location task.

H₀₂: There is no difference between multiple and linear imagery in a visual location task.

H₀₃: There is no interaction of perceptual type and presentation mode in a visual location task.

A 2X2 factorial analysis of variance was utilized to test the three hypotheses.

Limitations of the Study

The following limitations of this study was identified:

1. No test was administered to determine if any of the subjects had a visual handicap. Subjects were questioned relative to their having a visual handicap other than one which was corrected by corrective optics; students who did were eliminated from the study. On this basis, it was assumed that all subjects were normally sighted.

Definition of Terms

The terms used in the study, and the definitions applied to them were:

Visual perceptual type (Visual): A subject was designated as Visual if he gave 12 or more visual responses on Lowenfeld's Visual-Haptic Word Association Test and made at least one visual response and no haptic responses on the drawing version of Lowenfeld's Test of Subjective Impressions.

Haptic perceptual type (Haptic): A subject was designated as Haptic if he gave 12 or more haptic responses on Lowenfeld's Visual-Haptic Word Association Test and made at least one haptic response and no visual responses on the drawing version of Lowenfeld's Test of Subjective Impressions.

Multiple imagery: The presentation mode of multiple imagery referred to the simultaneous presentation of three separate images projected by three separate projectors, utilizing a 35mm format.

Linear imagery: The presentation mode of linear imagery referred to the sequential presentation of three separate images, each projected by the same projector, utilizing a 35mm format.

Supplantation: The function accomplished by an explicit presentation of what would otherwise have to be done covertly by the learner himself. In this study, the retention of visual images for identification was the process which was supplanted by the use of multiple imagery.

Organization of the study

The succeeding chapters are organized in the following manner:

1. Chapter 2 contains a review of literature and research related to Visual and Haptic perceptual types, multiple imagery, supplantation, and pictorial design.
2. Chapter 3 contains the procedures followed in conducting the study and the research methodology used in treating the data.

3. Chapter 4 presents the results of the study.
4. Chapter 5 includes the summary, conclusions, and recommendations for further research.

Chapter 2

REVIEW OF RELATED LITERATURE

The related literature for this study was categorized under the following topics: (1) Visual and Haptic perception, (2) supplantation theory, (3) multiple imagery, and (4) pictorial design.

Literature Relevant to Visual and Haptic Perception

Lowenfeld's typography. Lowenfeld's theory (1939) of the Haptic-Visual modes of expression grew out of his research on the art work of children in Austria and the United States. Differences in expressive style first became apparent during his many years of work with blind children. His observations indicated that some people, regardless of whether they were normally-sighted or blind, were inclined to graphically express themselves in fundamentally different ways. Through closer study and analysis, Lowenfeld identified two distinct perceptual types, based upon two unlike reactions to the world of experience. He labeled one type of expression "Haptic" and the other "Visual."

The extreme Haptic type of individual is a normal-sighted person who uses his body-self, muscular sensations, kinesthetic experiences, touch impressions, and all other experiences to place value upon the self as it relates to the environment. He does not transform kinesthetic and tactile experiences into visual ones, but gives meaning to and is content with just the bodily sensation itself; he is subjective in his creative expression of visual data

(Lowenfeld, 1957).

The Visual type of individual is characterized by the tendency to transform kinesthetic and tactile experience into visual images; he is entirely lost in the dark and depends almost completely on his visual awareness of the outside world. A Visual reacts as an observer, a spectator, who first sees the whole and then the details, and then synthesizes the total impression into a new whole. The Visual person observes the complex and ever-changing appearances of shapes and forms (Lowenfeld and Brittain, 1970).

Lowenfeld's study (1939) consisted of 400 drawings obtained from six to fifteen year old children who were assigned the same task of "draw yourself as you are taking the apple off the tree." From the results of this study he concluded that "the overemphasis and misproportions, the omission of some forms and the addition of others not apparently present, spring from the personal experience of shapes and movements, the stimulus for which is not visual (Lowenfeld, 1939, p. 76)." As Lowenfeld noted, this particular study was designed primarily to show the differentiation between visual and non-visual formative principles.

The tests developed by Lowenfeld (1945) for identifying individuals of the Visual and Haptic perceptual types are based on the principal distinctions between the two types. The tests, designed to discriminate between persons whose tendency is to use their eyes but are more attentive to those perceptions that derive from haptical experiences, included:

1. Test of Integration of Successive Impressions. This test is based on the ability of the Visual to integrate partial visual experiences into whole perceptual units. It requires the subject to view patterns a small section at a time and then choose, from among several variants, the patterns he saw. Since this task requires a perceptual skill typically possessed by Visuals but not by Haptics, Visuals typically perform far better on it than Haptics.

2. Test of Subjective Impressions. This test requires the subject to draw his concept of certain objects resting on a table. According to Lowenfeld, those who react visually will respond with a naturalistic attempt at representing the table in perspective; those who are haptically oriented will respond according to their emotional or subjective impressions of the objects on the table and change or ignore the naturalistic (perspective) mode of representing the table. Another version of this test measures the subject's inclination to respond visually or haptically to a series of questions concerning the number of floors contained in a building with which the subject is personally familiar. His response usually denotes visual, objective imagery (mentally seeing the building from the outside as a spectator) or haptic, subjective impressions (personally climbing each set of stairs in the building).

3. Test of Visual vs. Haptic Word Association. This test deals with words which incite associations equally from haptic and visual experience. Since haptic experience usually refers to the body-self, and visual experience to things outside which are

perceivable by ocular means, words were chosen which could be interpreted readily by either type. For example, one can "climb" a mountain or one can "climb" hard. Climbing hard conveys a subjective (body-self) involvement, but climbing a mountain conveys more objective, visual perception of outside objects.

4. Visualization of Kinesthetic Experience. Visualization of a kinesthetic experience is an inclination characteristic of the Visual type; this test consists of different shapes of geometric shapes with increasing complexity, and requires the subject to trace the edges or contours of the geometric shapes with his finger while blindfolded. After returning his moving finger to the starting point and removing his blindfold, he is asked to recognize visually the figure he has perceived kinesthetically from among five figures drawn on a tablet. Since they tend to visualize and integrate tactile and partial experiences, Visuals score higher on this test than do Haptics.

5. Test of Tactile Impressions. This test determines whether a subject can recognize figures which are perceived through tactile impressions. Simple geometric figures as large as the palm of a hand are placed one at a time into a bag. For each item, the subject has before him a tablet with several similar figures drawn on it. He is asked to reach into the bag and hold, touch, and move the figure in his hand. He is then asked to recognize the correct figure on the tablet. Correct responses are counted as haptic responses.

A refined version of Lowenfeld's original Integration of Successive Impressions (1945) was developed by Gibson (1944) upon suggestion by Lowenfeld. Gibson's Successive Perception Test I (SPT-1) was developed for use in the World War II Aviation Psychology program as a part of the pilot selection and training program. The SPT-1 is in motion picture form and is composed of three practice items and thirty-five test items. For each item, a slot in an opaque field moves over a black pattern set on a gray background, exposing successive parts of a pattern from top to bottom. The pattern is different and varies in complexity from item to item. After the pattern has been presented in this sequential manner, it appears on the screen in its entirety, along with four similar patterns which serve as distractors. The five patterns are labeled A through E. Subjects indicate recognition of the figure that was presented behind the moving slot by marking the appropriate space on an answer sheet. The test is scored by summing the number of items answered correctly.

Studies have indicated that the distribution of Visual and Haptic perceptual types is stable across populations. Lowenfeld's extensive study (1945) revealed that while most people fall between the extremes of the two types, few individuals have equal tendencies toward visual and haptic perception. He found that approximately 75% of the subjects he tested showed a definite tendency toward one type or the other, with about 50% exhibiting visual tendency and about 25% exhibiting haptic tendency. He established the following theoretical distribution of perceptual types of any given

population: Visual, 50%; Haptic, 25%; and Indefinite, 25%. This theoretical distribution coincides with the distribution of "visualizers," "mixed types," and "non-visualizers" found by Walter (1953) in a completely independent study based on brain alpha rhythms. Recent studies by Ausburn (L.J., 1975) and Ausburn (F.B., 1975) reported obtaining a distribution of Visuals, Haptics, and Indefinites very similar to Lowenfeld's.

Witkin's Field-Dependent-Field-Independent Types. The beginning of Witkin's work can be traced back to the work of Gestalt psychologists who were concerned with part-whole relationships in the perceptual process. In his very early works Witkin (1954) discovered that the Gestalt principles involving part-whole relationships failed to account fully for the behavioral characteristics of his subjects. Thus, Witkin and his associates began their long and exhaustive study of individual differences in perception, which has ultimately led to their theory of "Psychological Differentiation."

Initially, Witkin (1948) found that people differ in their orientation to space:

. . . it became clear at a certain point in the investigations that the method in which a person orients himself in space is an expression of yet a more general mode of perceiving which, in turn, is linked to a broad and varied array of personal characteristics involving a great many areas of psychological functioning (Witkin, 1962, p.1).

These modes of perceiving, called Field-Dependence-Field-Independence, were the first and most basic construct of his work and emerged from his studies of perception of the upright in space (Witkin, 1948, 1949a, 1949b, 1949c, 1950a, 1950b, 1952).

The construct of Field-Dependence-Independence proved, in the course of Witkin's work, to be the underlying ground work on which "indicators" of differentiation manifest themselves in psychological functioning. These postulated indications, which, according to Witkin,

. . . are dynamically interrelated and ordinarily difficult to separate, include an articulated way of perceiving the world; a differentiated self as reflected particularly in a clearly defined body concept, and a developed sense of separate identity; and specialized, structured controls and defenses (Witkin, 1962, p.22).

Studies concerning the construct of a "differentiated self," for instance, revealed psychological traits which seem directly related to Lowenfeld's theory of Haptic-Visual types. Witkin indicated that "one of the very early developments in the crystallization of experience is the growing awareness of a difference between inner and outer within the original body field (Witkin, 1962, p.12)." In reference to this observation, Witkin stated:

The developing sense of self is rooted in, but obviously not limited to, sensations generated by body functions and activities (as hunger, satisfaction of thirst, change in position, pain). Various other kinds of experiences (as emotions, ideas, memories) come to be perceived as emanating particularly from within and are distinguished from experiences which have their source "out there" (Witkin, 1962, p.12).

Such discussion is closely similar to Lowenfeld's description of the Haptic type who experiences from "within" and the Visual type who gives meaning to his experiences as would a spectator--experiencing his surroundings as separated from himself.

Witkin's work indicates that the "Body Adjustment Test" (BAT) and the "Room Adjustment Test" (RAT) measure ones ability to perceive

the self (the body) in relation to the upright. These tests which focus attention upon the separation of the body from the environment (part from whole), discriminate between those who depend upon body cues (Field-Independent) and those who depend upon the visual field (Field-Dependent) to orient themselves in space--as noted by their approximation to the upright. Therefore, if a Haptic person, who is inclined to perceive more readily through bodily cues such as tactile and kinesthetic sensations is able to discriminate his body position more accurately in relation to the upright than the person who is dependent upon the visual field, it follows that the Haptic type would be described as field-independent according to Witkin's criteria (Howell, 1972).

Subsequent to the development of the RFT, RAT, and BAT was the Embedded Figures Test (EFT) which involves the ability to perceive an item independently of its context and does not involve body position. The EFT has been used in a great many studies dealing with perception and cognition. Recent studies pertinent to this research were those by Lovano (1970), Reeves (1971), Stuart (1965), McWhinnie (1970), Pillsbury (1967), and Howell (1972).

Since Lowenfeld's Haptic-Visual types were identified initially by their "expressive styles," Lovano's study seemed especially significant in that it connected styles of perceiving, styles of cognition, and styles of graphic expression. According to Lovano, graphic expressions of the same age appeared to be related to preferred modes of perception, and to some extent,

to preferred modes of cognition.

Reeves' study (1971), which hypothesized that differentiation (Field-Dependence-Independence) could be altered through certain kinds of perceptual-training methodologies, concluded that, "Contrary to the findings of Witkin and other researchers, . . . it is definitely possible to alter differentiation as defined by the EFT (Reeves, 1971, p. 12)." Though Reeves did not pursue the issue, this finding raises the frequently asked question as to whether perceptual and cognitive styles are results of physiological or environmental determinants.

On this subject Stuart, et. al. (1965) compared the degree of field-dependency of identical and fraternal twins on Witkin's Embedded Figures Test. The results indicated significant genetic influences upon an individual's mode of perception as measured by the EFT. Witkin acknowledged that, "An interaction approach offers the most reasonable route for seeking an answer to such a question physiological vs. environmental . . . Variations in constitutional characteristics are without doubt critical in determining individual differences, although at present the nature of these characteristics can only be a matter of speculation (Witkin, 1962, p. 18)."

As noted by McWhinnie (1970) in his review of recent literature in this perceptual-cognitive area, such inconsistencies in the literature would seem to bring art education theory back full circle to Lowenfeld's conceptualization of Visual and Haptic types.

Significant physiological correlates of perceptual style have been found by Pillsbury (1967), who compared Field-Dependent-Indepen-

dent characteristics with electroencephalographic recordings of alpha waves transmitted in the brain. Howell (1972), in an electroencephalographic comparison of Lowenfeld's Haptic-Visual theory and Witkin's Field-Dependent-Independent theory, reported that Haptic types tend to match Field-Dependent types and Visual types tend to match Field-Independent types. Howell's data were contradictory to what had been expected.

Lowenfeld's influence. Lowenfeld's influence in art education has been more dominant than any other single personality (Eisner, 1972). Howell (1972) reported that upon publication of his second book entitled Creative and Mental Growth (1947), over 200 colleges and universities adopted it as a basic text in art education. Wide acceptance of his text and his position as Chairman of Art Education at Pennsylvania State University soon identified Lowenfeld as the leading art educator. As his momentum grew, the concepts of the Haptic-Visual perceptual types grew also (Howell, 1972).

There have been some studies which have attempted to relate the Haptic-Visual theory to achievement. Erickson (1964, 1967) found that students' perceptual orientation was a significant factor in the development of skill in using some forms of graphic communication. Another study by Erickson (1969) indicated that the mean level of reading achievement for Haptic perceptual types was from one half to one full grade level below Visuals at the seventh grade level. A study by Todd (1976) indicated that Visuals tended to score higher than Haptics on teacher-made achievement tests.

Ausburn (F.B., 1975) conducted a study to determine the effects of multiple imagery for Haptics and Visuals in a comparative visual location task. He found that both Visuals and Haptics benefited from multiple image presentations.

Literature Relevant to Supplantation Theory

Supplantation is defined by Salomon (1970) as follows:

To supplant mental processes means to execute them explicitly for the learner. A mental process is supplanted when an analogous process is overtly executed in front of the learners eyes. Thus, supplantation is the function accomplished by an explicit presentation of what would otherwise have to be done covertly by the learner himself, such that a certain learning objective will be attained (Salomon, 1970, p. 46).

In the literature pertaining to supplantation theory, three major principles have emerged:

1. Supplantation of a mental process which is not necessary to the learning task at hand does not facilitate its attainment. Thus, knowledge of the nature of the mental processes underlying a task is necessary in order to devise a presentation to attain it through supplantation (Salomon, 1970).

2. A presentation designed for supplantation must be sufficiently explicit to provide enough supplantation of mental process to allow an item to be learned, a concept to be attained or a principle to be formulated. Salomon (1970, p. 50) states that supplantation is not an all or none function." He states that on a continuum of supplantation, various points can be identified. These points include presentations which attempt only to induce the necessary mental activities by showing nothing but the beginning

state of a process; presentations that short-circuit the necessary chain of mental transformations by presenting the initial situation and its final modification; presentations that provide the initial situation and its transformation; and finally, presentations which attempt to be most explicit and to supplant as much as possible (Salomon, 1970). Salomon's conclusion is that various amounts of supplantation can be effective. How much is necessary in a given situation is a function of task requirements and learner characteristics.

3. In order for supplantation to occur, a presentation must contain information which the learner is capable of placing into his cognitive structure and his stage of development. Berlyne (1965) states that transformations are not learned simply as a result of witnessing the transformations in question. Ausubel (1968) claims that such transformations are not learned until the learner can assimilate them into his cognitive structure, hence giving them "meaning."

Since supplantation is an internal process, its presence must be inferred from observation of its results. In a study in which film was used to show explicit demonstrations, Sullivan (1967) demonstrated that children's conceptions of conservation, space, and causality can be modified through such demonstrations. When the mental processes involved in the formation of these concepts were supplanted through the use of explicit film presentations, the result was better performance on tasks requiring grasp of concepts.

Gentile, Kessler, and Gentile (1960) reported the supplantation

of the process of finding as association. They provide the required association for subjects and reported the results. They reported that while relationships given to subjects which are congruent with those the subject would have generated by himself facilitate performance on analogy items, given relationships which are incongruent with those the subject would have generated hinder performance. They also reported that when a treatment is used in which relationships are given to subjects, they do not generate their own relationships. They concluded that this treatment would probably not facilitate transfer because the subject was not given any practice opportunity.

Literature Relevant to Multiple Imagery

Multiple imagery, the simultaneous presentation of visual images, has become a popular technique in education. As Fradkin (1974) points out, the production of multiple image presentations is abundant, but there is little empirical evidence to support multiple imagery as a successful learning technique. A theory of multiple imagery has been presented by Perrin (1969, p. 369):

Media such as films, television, filmstrips, and slides have, until now, presented their images sequentially. In sequential montage the meaning of each new image is determined by the context of what has gone before. In its temporal aspects, sequential montage is analogous to verbal language, where several elements in series determine the total meaning. Simultaneous images interact upon each other at the same time, and this is of significant value in making comparisons and relationships. An important contributing factor is screen size. On small screens, the overall identity of the image is most significant. On large screens (or screens side-by-side), the viewer makes his own montage of different

image elements, increasing the probability of learning comparative information. The immediacy of this kind of communication allows the viewer to process larger amounts of information in a very short time. Thus information density is effectively increased, and certain kinds of information are more efficiently learned.

From the literature, there appear to be three major factors which serve to distinguish multiple-image presentations from the conventional use of media:

1. simultaneous images,
2. screen size, and
3. information density.

Simultaneous images. Perrin (1969) asserts that it is axiomatic that simultaneous images are more effective than sequentially presented images. Millard (1964) lists a variety of classroom situations where the simultaneous presentation of images would be advantageous:

The multiple-image technique enables the teacher to make comparisons, to illustrate the development of inter-related concepts, show relationships, and to otherwise combine the capability of several photographs aids either simultaneously or in some programmed pattern or sequence for instructional purposes.

Using multiple images, we can effectively treat comparisons of the physical, geographical, environmental, dimensional, and spatial characteristics of objects and events. Dichotomies, alternatives, differences, likenesses, and many other forms of comparison can likewise be efficiently handled by this method.

In a similar way presentations involving relationships, parts to whole, diagrams of apparatus, model to object, form to function, and the like, can be displayed with multiple images (Millard, 1964, p. 108).

A basic mechanism of learning is by association (Gagne, 1965). Low (1968) hypothesizes that the complex of simultaneous visual associations is especially crucial to memory and to conceptual

learning. Perrin (1969) points out that images are especially rich in information and in the range of associations they stimulate. Without careful control by the communicator, there is the possibility that some associations can conflict with the intended message and be detrimental. Relevance, realism, and simplicity have been found to be important in learning from book illustrations (Spaulding, 1956), and in learning from films (May and Lumsdaine, 1958). These factors are equally important in presentations utilizing multiple imagery (Perrin, 1969).

A caution which emerges from the literature concerning the simultaneity of multiple images is that the theory of cue summation may not be valid in some contexts. Cue summation is a general theory which posits that the more cues are given through various communication channels, the more learning occurs. Perrin (1969) points out that the use of simultaneous multiple images places a burden on the visual channel and that in the multiplication of visual stimuli, irrelevant as well as relevant detail is increased. Therefore, care must be taken to assure that the visual stimuli are clear and simple and that detail included is relevant. Otherwise the result is not cue summation, but confusion.

In an extensive review of multi-channel communication, Hartman (1961) is critical of the use of verbal and visual elements in many educational materials, particularly in educational films:

A common practice among multiple channel communicators has been to fill the channels, especially the pictorial, with as much information as possible. The obvious expectation is for additional communication to result from the additional information. However, the prob-

ability of interference resulting from the additional cues is very high. The hoped-for enhanced communication resulting from a summation of cues occurs only under special conditions. Most of the added cues in the mass media possess a large number of extraneous cognitive associations. The possibility that these associations will interfere with one another is probably greater than that they will facilitate learning (Hartman, 1961, p. 27).

A study by Fradkin and Meyrowitz (1975) supports the hypothesis that cue summation and the avoidance of conflicting cues is important in the design of multiple image presentations produced for cognitive learning situations.

Screen size. The use of the large screen coupled with the simultaneous projection of two or more images has been cited as one of the major and inherent advantages of multiple imagery. The large screen provides better approximations of "real" environments by supplying the physical and psychological factors necessary for realism and involvement (Perrin, 1969).

It would appear logical to assume that tasks requiring high visual acuity would benefit from large screen presentation. A study by Blackwell (1968), however, proposes that caution must be observed when operating on the assumption that increased visual acuity always results through the use of large screens. Blackwell found that in normal room environments, visual acuity is enhanced by increase in illumination and degraded by uneven lighting, reflections, and glare. He combined these into a single factor which he termed relative contrast sensitivity, which he described as follows:

Difficult tasks require relatively high levels of

background luminance, whereas easy tasks require low levels of relative contrast sensitivity and luminance . . . Thus, when more contrast sensitivity is supplied to the visual system, not only can the learner read smaller print or handwriting of lower contrast, but he can also detect more subtle changes in facial expression, and for example detect smaller differences in texture or pattern (Blackwell, 1968, p.40).

The implication of Blackwell's assertions is that screens should be fully illuminated and that projection materials should be of correct density. Insufficient illumination or dense slides and films serve to degrade visual acuity. If large screens are achieved with loss of illumination, other possible advantages of the larger screen size can be negated (Perrin, 1969).

Ambient light is also a contributing factor to relative contrast sensitivity. Visual information is lost where ambient light which is reflected from the screen exceeds the blackest black in the film (Perrin, 1969). Logan (1948) found in his experimental studies that ambient light levels at the screen should not exceed 0.1 foot-Lamberts where the ASA standard screen brightness of 16 foot-Lamberts is used.

Perrin (1969) asserts that under ideal viewing conditions the limits of visual acuity will be determined by the resolution of the film and visual transmission system rather than by the viewing environment. This has led theatrical film producers to use wider than normal film gauges, at least for the initial photography. In this manner the larger screen does not have objectionable graininess, and the full visual capability of the observer can be utilized. Therefore, visual acuity is directly

related to resolution of the image transmission system, screen size, screen brightness, and the freedom from degradation due to ambient light, reflections and glare, and distractions within the visual field (Perrin, 1969).

There are some researchers who feel that the physiological impact of large screens is as important as the psychological impact. Schlanger (1966) introduced the two terms visual impact factor and visual task factor in respect to the physiological impact of large screens. His rule for the visual impact factor is that as the screen size increases relative to audience size, visual impact increases. Some have postulated that the development of large screens and the sheer physical impact they produce was necessary for the survival of the motion picture art. Cornwell-Klyne (1954) suggested that the motion picture would be destined to suffer a slow decline in popularity unless it renewed its vitality as it increased effort to expand its powers of communication and expression with a large-screen format. Perrin (1969) suggests that the reason movie audience declined in the late forties was that they were watching films on television, but that in the next decade large screen motion pictures provided the added impact necessary for theatres to compete with the convenience of home viewing.

Schlanger's visual task factor relates to the work the viewer must do to extract the necessary information. Schlanger (1966) declares that on the small screen associated with television and narrow gauge films, the resolution of the image is limited. Large

screens receiving their images from wide gauge film are rich in detail, and in this respect they more closely duplicate a real environment. As a result, the large and well-resolved images produced on wide films and shown on large screens result in less physical effort by the viewer; the visual task factor is reduced.

Barr (1963) believes that the primary reason that people learn successfully from presentations on large screens is the psychological impact they produce. He believes that the viewer perceives himself as part of the environment instead of "looking through a window." The openness of the large image encourages exploration and selection, giving a sense of reality and participation to the viewer. In addition, the director has relinquished his image-by-image storytelling and capitalizes on the advantage of simultaneous montage (Barr, 1963).

TerLouw suggests that the increased learning which he observed with the use of large images is related to the increased interest which they produced. In an informal experiment, TerLouw (1956) set up a slide projector with a small screen and invited people individually to view some slides, controlling the rate of presentation for themselves. Upon repeating the experiment with a large screen, he found the subjects viewed each slide for nearly twice as long. A posttest showed that this second group was better able to answer questions on details and relationships within the pictures.

Information density. A greater density of information is possible with multiple than with linear imagery. There are several

dimensions to information density in multiple-image presentations. Perrin (1969) believes that it is important to distinguish between the method of presentation and the mechanism of perception. He states that the theory of multiple images suggests that for making contrasts and comparisons, and for learning relationships, "simultaneous images reduce the task of memory (a dimension of visual task) and enable the viewer to make immediate comparisons (Perrin, 1969, p.376)." Large images and multiple images facilitate this, as shown by TerLouw's experiment.

Langer stresses simultaneity as a basic element in visual language:

Visual forms--lines, colors, proportions, etc.--are just as capable of articulation, i.e., of complex combination, as words. But the laws that govern this sort of articulation are altogether different from the laws of syntax that govern language. The most radical difference is that visual forms are not discursive. They do not present their constituents successively, but simultaneously, so that relations concerning a visual structure are grasped in one act of vision. Their complexity, consequently, is not limited, as the complexity of discourse is limited, by what the mind can retain from the beginning of an apperceptive act to the end of it (Langer, 1957, p. 83).

Langer utilizes the terms linear and nonlinear to distinguish between verbal and iconic signs. She stresses the sequential ordering, the "strung-out" arrangement of linear (verbal) signs in time and contrasts this to the "all-at-once" character inherent in pictorial signs. Her position is that even single pictures shown in sequential order are essentially nonlinear.

Nonlinearity and simultaneity go hand in hand. The use of visual images, inherently nonlinear, allows the presentation of

a great deal of information simultaneously rather than sequentially, as with words arranged in sentences and thus bound to grammatical ordering and syntax. Perrin (1969) expands this line of analysis and hypothesized that when visual images are combined in multi-image presentations, the result is an increase in the amount of information which is presented simultaneously, or in the information density of the presentation.

Information density can be further increased if the information is organized properly. McFee believes that visual organization is more important than the actual amount of information present:

Visual ordering makes messages of content easier. Much of our responding is so fast we are unaware of the processing we do. One of the tasks of the message designer is to make the visual sorting process easier; he selects and organizes visual information so that it is easier for the viewer to assimilate (McFee, 1969, p. 85).

Investigative confirmation of the importance of organization is illustrated by the introduction of a carefully organized and automated televised instructional system called TeleMation at the University of Wisconsin. It was found by Hubbard (1961) that a tape lecture of 50 minutes could be boiled down through careful organization to 20 minutes of TeleMation instruction with no loss of material or loss of learning by students. Information density could be significantly increased through proper organization. A similar finding resulted when the Army Ordnance Guided Missile School conducted a series of evaluative studies in 1958 (U.S. Army, 1959). Three 32-hour segments of instruction were utilized emphasizing different kinds of subject matter. Instruction

time was reduced 19.5 to 41 percent for a similar level of achievement, and an increment in learning was reported for the experimental groups nine weeks later. Allen and Cooney (1963) suggested that time saved in instruction was as much a function of care in preparation as it was a function of the multi-imaged delivery of the subject matter.

Commercial producers claim that information density created through multiple imagery results in motivation and arousal. A serious question is whether or not this arousal is beneficial. Research on motivation indicates that increase in motivation improves performance (Smith, 1975), but that there is an optimum level. Eysnck (1963) found that for complex tasks optimum performance is achieved when drive is relatively low; only for simple tasks is the optimum achieved with relatively high drive. Kleinsmith and Kaplan (1963, 1964) and Kleinsmith, Kaplan, and Tarte (1963) found that there is some confusion between learning and performance, with a person sometimes performing very poorly in highly arousing situations, yet tending to remember most vividly those incidents in his life which were most traumatic or arousing. These researchers measured skin conductivity, and their findings indicated that high arousal associates showed stronger permanent memory and weaker immediate memory than low arousal associates. Low arousal was accompanied by the normal forgetting curve. High arousal responses showed poor immediate recall with reminiscence.

This explains some inconsistencies in research with regard to long term retention. For example, VanderMeer (1951) found color

films did not increase immediate learning, but produced greater long term retention. The findings of Kleinsmith suggest that the cause may have been the arousal produced by the color films.

Perrin (1969) notes that in goal setting, it is important to distinguish the nature of the learning outcome. If immediate performance is the goal, factors which induce arousal (interest, excitement, visual impact, emotion, etc.) would be lower than for situations where long term retention is the goal. Research needs to be conducted to determine if multiple image montage produces too much arousal to make it useful for some short-term learning tasks. It may be better suited to the inducement of long-term learning through high arousal (Fradkin, 1974).

Literature Relevant to Pictorial Style

A considerable body of research has accumulated on the effects of pictorial detail. The superiority of simple line drawings over those containing greater detail in concept learning is well documented. Travers (1967), reviewing the current concept-formation literature, states that most information is transmitted by boundaries, and hence a representation that emphasizes the boundaries and deemphasizes other information provides an effective means of transmission. He further notes that varying amounts of relevant and irrelevant information in a visual can affect the learning of a concept.

Results, which are contradictory in several respects, suggest that line drawings or other types of images with detail deleted

tend to be a more effective means of communicating information than are photographs or extremely detailed pictures (Bloomer, 1960; French, 1952). Studies concerning the value of the type of picture with reference to instruction and chronological age of student show that younger children prefer simple illustrations showing little detail (French, 1952). Young children tend to look at parts of an illustration rather than the illustrations as a whole (Miller, 1938; Elkind, Koegler, and Go, 1964). The ability to receive information from a picture tends to be a developmental process (Travers, 1970).

Ryan and Schwartz (1956) reported that line drawings required the longest times for perception, while cartoons required the shortest perception time. Photographs and shaded drawings were about equal in perception time and fell between line drawings and cartoons. An earlier study by Ryan and Hochberg (1954) showed similar results.

Travers (1966) hypothesized that line drawings are advantageous because they eliminate superfluous detail. Travers' experiments show poor transfer of learning from simplified drawings and models to situations in a real learning environment. Perrin (1969) asserts that the line drawing, like an image with poor resolution, increases the visual task factor to reconstruct visual cues which are lost in the abbreviated form.

Dwyer (1972) conducted a series of studies and a review of the research on visual presentations ranging from highly realistic color photographs to simple black and white line drawings. He con-

cluded that the effectiveness of different types of visuals varied depending upon the conditions under which they were used and the objectives they were expected to achieve. More realistic visuals were more effective with such internally paced material as textbooks and programmed instruction. Simple line drawings tended to be more effective with externally paced instruction such as that of slide and television presentations.

A consideration of research relating to the retention of pictorial information was pertinent to this study. Studies by Nickerson (1965), Shepard (1967) and Standing, Conezio, and Haber (1970) indicated that observers can recognize pictures which they have seen with at least 90% accuracy. In each of these studies, the subjects had at least five seconds to view each picture and were able to pay undivided attention to them. Loftus (1972) found that recognition of the picture is reduced when subjects are required to perform a distracting task while viewing the picture. Potter and Levy (1969) found that subjects could remember pictures with over 90% accuracy with a viewing time for one or two seconds.

Summary

The existence of a typography of perceptual types was demonstrated by Lowenfeld (1939, 1945). Lowenfeld (1945) developed a battery of tests to identify perceptual types. Studies have shown that the distribution of perceptual types is stable across populations: Visual, 50%; Haptic, 25%; Indefinite, 25% (Lowenfeld, 1945; Ausburn, L.J., 1975; Ausburn, F.B., 1975, 1976). Usage of

the Haptic-Visual theory has primarily been confined to the teaching of art (McWhinnie, 1970; Howell, 1972; Lowenfeld, 1945; Lovano, 1970; Grossman, 1970). Some studies sought to relate the Haptic-Visual theory to achievement. Erickson (1964, 1967) found that Visuals demonstrated higher performance in mechanical drawing than Haptic students. Erickson (1969) also found that Haptic students were one half to one year behind Visuals in reading achievement at the seventh grade level. Todd (1976) also reported findings that indicated greater achievement by Visuals than by Haptics.

A primary distinction between Visuals and Haptics is that Visuals can mentally retain visual imagery while Haptics cannot (Lowenfeld, 1945). Since multiple imagery allows the individual to view all necessary information simultaneously (Perrin, 1969), it seems reasonable to expect that multiple imagery may be able to accomplish a theoretical process known as supplantation (Salomon, 1970).

Although a considerable amount of research has been generated in attempts to compare the effects of multiple imagery with those of linear imagery in both the cognitive and affective domains, this research has been contradictory and inconclusive. While some studies (Reid, 1970; Lombard, 1969) indicate the superiority of multiple image presentations, others (Didcoct, 1972; Fradkin, 1971) indicate no significant difference in results with multiple and linear image presentations. Still others (Fradkin, 1974) indicate the superiority of linear imagery. Ausburn (F.B., 1975)

found that both Visuals and Haptics benefited from multiple image presentations. The successful development of the multiple image presentation as an educational medium still requires an empirical test of what contributes to its effective use as a learning technique (Fradkin, 1974). With the exception of Ausburn (F. B., 1975), studies attempting to compare multiple and linear imagery made no attempt to utilize individual differences such as perceptual types.

Studies relative to the effects of pictorial detail were inconclusive. Some studies indicated the superiority of simple line drawings over photographs, or extremely detailed pictures (Bloomer, 1960; French, 1952). Perrin (1969) indicated that line drawings increased the visual task factor to reconstruct visual cues. Dwyer (1972) concluded that the effectiveness of different types of visuals varied depending upon the conditions under which they were used and the objectives they were expected to achieve.

Studies have indicated that line drawings required the longest times for perception, while cartoons required the shortest perception time. Photographs and shaded drawings were about equal in perception time and fell between line drawings and cartoons (Ryan and Schwartz, 1956; Ryan and Hochberg, 1954). Potter and Levy (1969) found that subjects could remember pictures with over 90% accuracy with a viewing time of one or two seconds. Other studies (Nickerson, 1965; Shepard, 1967; and Standing, Conezio, and Haber, 1970) reported 90% accuracy in studies which used a viewing time of at least five

seconds.

In the review of related literature, there were no indications which could be regarded as definitive relative to the use of multiple imagery. The literature supports the existence of a typography of perceptual types as indicated by Lowenfeld. However, no empirical evidence can be found concerning the use of perceptual types in the design of visual media. This study is an attempt to add empirical evidence to the effectiveness of multiple and linear imagery in a visual location task for Haptic and Visual perceptual types.

Chapter 3

RESEARCH METHODOLOGY

Introduction

The purpose of the study was to determine the effects of multiple and linear imagery on performance in a visual location task. The study also considered whether the scores in a visual location task were affected by the interaction of presentation mode (multiple and linear imagery) and perceptual type (Haptic and Visual).

Tests to Determine Perceptual Type

The perceptual type of 200 students was determined by their scores on two tests: Lowenfeld's Visual-Haptic Word Association Test and Test of Subjective Impressions. These tests were selected because of their availability and their ease of administration and scoring. Students were classified according to their perceptual type on each of the tests according to procedures developed by Lowenfeld (1945) and Gibson (1944). For this study, students who were classified as Visual on both tests were designated as Visual (N=76); students who were classified as Haptic on both tests were designated as Haptic (N=70).

The first test which was administered was the drawing version of Lowenfeld's Test of Subjective Impressions (1945), which requires the individual to draw a glass or chessboard on a table. Lowenfeld found that Visuals typically respond by drawing an objective view of the table in proper perspective, while Haptics typically draw a subjective impression, ignoring perspective and relating themselves to the object on the table. Most visual responses were side views of the table and

were complete with legs. A haptic drawing was defined as subjective with emphasis on the glass or chessboard as if using the item personally. Perspective was ignored in haptic drawings. A subject was classified as Visual on this test if he made at least one visual response and no haptic responses. A subject was classified as Haptic on this test if he made at least one haptic response and no visual responses. Figure 1 shows typical visual and haptic responses.

The second test which was administered was Lowenfeld's Visual-Haptic Word Association Test (1945). This test consists of twenty words which elicit visual and haptic responses equally well. Visual responses (such as "climb--tree") are those in which a visual object is given as the association. Such a response conveys an objective, visual perception of an external object. Haptic responses (such as "climb--hard") are those in which a muscular, physical kinesthetic, or emotional word is given as the association. Such a response conveys a subjective and physical involvement and a kinesthetic and internal rather than visual and external orientation.

Subjects were given the list of words (see Appendix A) and asked to react to each word with the first association which came to mind. To be classified Haptic on this test, a subject made at least 12 haptic responses; subjects who made at least 12 visual responses were classified as Visuals. Flick (1962) found the reliability of this test to be .81.

Preparation of the Experimental Task

The experimental task of this study was a visual location task. It

Figure 1. Typical Haptic and Visual Responses

was designed to test the subjects' ability to view three black and white 2X2 35mm slides representing three quadrants of a criterion picture. The subjects were required to choose the criterion picture from a group of three similar pictures. The test required the subjects to utilize the visual cues in each of the three slides in order to select their responses. Figure 2 illustrates the experimental task.

Selection of pictures. To prepare the experiment, 40 groups of three similar pictures were selected by the experimenter. These pictures represented a variety of pictorial styles, ranging from highly detailed pictures to simple line drawings. Various books dealing with art provided the source for the pictures. The groups of pictures were photographed and a 2X2 black and white positive slide was produced of each picture. This allowed the pictures to be reviewed in a consistent format as well as to eliminate the compounding factor of color.

A panel of four graduate students in the College of Education at Virginia Polytechnic Institute and State University who were unfamiliar with the experiment but knowledgeable in the area of art were asked to judge whether or not the groups of three pictures were similar. These four persons were asked separately to evaluate each group of pictures, using the criteria that each group must be similar in content (inclusion of similar detail), style (similar artist technique), and format (similar placement of pictorial content). Thirty (30) of the forty (40) groups were adjudged similar by all members of the panel and these thirty (30) groups were included for potential use in the experiment. The experimenter randomly selected one picture from each of the picture groups to

QUADRANTS

SIMILAR PICTURES

Figure 2. Illustration of the Experimental Task

become the criterion picture. Three of the quadrants of each criterion picture were then selected at random for use in the experiment. This random selection as well as all random selection in this study was accomplished by "pulling numbers out of a hat."

Preparation of the slides. The photographing of the pictures from books necessitated the utilization of a copy stand, two flood lights, and a 35mm single lens reflex camera. Preparation of the slides for determining the similarity of pictures alerted the experimenter to some aspects of concern in the preparation of slides for the experiment. Few of the pictures that were selected for use in the experiment were of the size that would allow inclusion of the entire picture in a full-frame 2X2 slide. Because the experimenter wanted consistency of projection area for all slides used in the study, it was necessary to eliminate portions of most of the pictures used. This also allowed the experimenter to selectively eliminate unwanted detail such as the artist's signature or identification numbers imposed on the pictures.

Since all detail was not included in the slides of the pictures, division of the criterion pictures into quadrants was made more difficult. Attempts to block the picture into quadrants during the photography process proved to be ineffective.

A procedure which involved photographing each criterion picture five successive times from the same position was finally utilized. Three of the slides were divided into quadrants and masked using mylar tape. The pictures determined as similar to the criterion pictures were photographed two successive times in the same manner as the

criterion picture. All photography was accomplished using Kodak Panatomic-X type film. The experimenter photographed and developed each of the slides. Appendix B includes the test items as they were used in the experiment.

Pilot study. A pilot study was conducted February 28, 1978, to fifteen (15) students at Wytheville Community College. Findings as a result of the pilot study served to refine the experiment in several ways:

1. The number of test items was reduced from thirty (30) to twenty (20). Items which appeared to be either too easy or too hard were eliminated from use in the actual experiment.
2. Because of the amount of clarification that was made necessary before beginning the experimental task, the instructions were made more specific (see Appendix C).
3. Two practice items were presented instead of one. This change was made because some students felt they were still unsure of how to proceed after one practice item. All students agreed that after two practice items, they were fully aware of the required procedure.
4. Informal questioning of students as to how they tried to remember the information they had seen, revealed several different approaches. Therefore, a series of questions asking subjects to indicate how they approached viewing the slides was included at the completion of the experiment (see Appendix D).

The pilot study also served to affirm several areas relative to the implementation of the experiment:

1. It was surmised that the experimental task was of sufficient

difficulty. The reliability estimate produced by the Kuder-Richardson #20 formula was .72.

2. The seminar room to be used in presenting the experiment was dark enough for students to view the slides; likewise, there was adequate light to mark response sheets.

3. The experimenter announced the item numbers as well as when to mark response sheets. Students felt that this helped them to mark their response for the proper item.

Population and Sample

The subjects for the study were selected from a group of 200 students who were enrolled in daytime English classes at Wytheville Community College in southwestern Virginia. English classes were chosen because of their inclusion of a wide range of student academic and occupational majors, ease of access, and size of classes. The sample consisted of forty-six (46) freshmen and thirty-four (34) sophomores; thirty-eight (38) were male and forty-two (42) were female. Subjects ranged in age from seventeen (17) to fifty-two (52).

Data Collection

The 200 students were administered the two tests and classified according to their perceptual types. Students who scored as Haptic on both tests were designated as Haptic (N=70); students who scored as Visual on both tests were designated as Visual (N=76). All others were classified as Indefinite (N=54). In order to ascertain whether the observed frequency distribution was significantly different from that which was theorized by Lowenfeld, a chi square test for goodness

of fit (Ferguson, 1971) was performed. The results of this test are presented in Chapter 4.

From the Visual and Haptic groups, forty (40) Visuals and forty (40) Haptics were selected at random. Each group of forty (40) was further randomly split into groups of twenty (20) and assigned to treatment groups; twenty (20) Visuals and twenty (20) Haptics were designated to receive the linear image presentation; twenty (20) Visuals and twenty (20) Haptics were designated to receive the multiple image presentation. The test was administered to twenty (20) students at a time, ten (10) Visuals and ten (10) Haptics for each of the presentations.

Prior to the presentations three (3) carousel projectors were placed 12 feet from each screen (see Figure 3). Portable Da-Lite seventy inch matte screens were positioned adjacent to each other at the front of the room. Sample slides were focused and adjusted on the screens. The seminar room which was used for each of the test administrations was equipped with elevated seating and adjustable desk tops of sufficient size for the response sheets. Although the room was sufficiently dark for slide projection, enough light was available for marking answers on the response sheet (see Appendix E).

The instructions were read to the students followed by two practice items. Opportunity was given for questions of procedure. For each item on the test, the experimenter announced the number of the item as well as when to mark the response sheet.

The linear image presentation utilized the following procedure for

Figure 3. Placement of Screens and Projectors for the Experimental Task

each of the twenty (20) items in the experiment:

1. Slide 1. Projector one displayed one quadrant of the criterion picture onto screen #1 for two (2) seconds.

2. Slide 2. Projector one displayed a second quadrant of the criterion picture onto screen #1 for two (2) seconds.

3. Slide 3. Projector one displayed a third quadrant of the criterion picture onto screen #1 for two (2) seconds.

4. Slide 4. Projector one displayed a blank slide for ten (10) seconds.

5. Slides 5, 6, and 7. Slides 5, 6, and 7 were projected simultaneously for a period of six (6) seconds. One of the three similar pictures was the criterion picture. Projector one displayed the first of three similar pictures (slide 5) onto screen #1; Projector two displayed the second of three similar pictures (slide 6) onto screen #2; Projector three displayed the third of three similar pictures (slide 7) onto screen #3.

6. Slides 8, 9, and 10. Slides 8, 9, and 10 were blank slides and were displayed by the projectors. Subjects were required to select the criterion picture and mark their response on the answer sheet.

In the multiple image presentation, each group of subjects was shown the same slides and in the same order as in the linear image presentation; however, the slides for each item were presented simultaneously by three separate carousel projectors onto 3 separate screens. For each item, the following procedure was used:

1. Slides 1, 2, and 3. Slides 1, 2, and 3 were projected simultaneously for a total of six (6) seconds. Projector one displayed a

quadrant of the criterion picture (slide 1) onto screen #1; Projector two displayed a second quadrant of the criterion picture (slide 2) onto screen #2; Projector three displayed a third quadrant of the criterion picture (slide 3) onto screen #3.

2. Slides 4, 5, and 6. Slides 4, 5, and 6 were blank slides which were projected simultaneously by the three projectors for ten (10) seconds.

3. Slides 7, 8, and 9. The three similar pictures (slides 7, 8, and 9), one of which was the criterion picture, were projected in the same manner and for the same length of time as in the linear presentation.

4. Slides 10, 11, and 12. Slides 10, 11, and 12 were blank slides which were displayed by the three projectors while subjects were required to select the criterion picture and mark their response on the answer sheet.

The time required for the test administration was 9 minutes. At the completion of the test, subjects were requested to answer a series of questions regarding how they tried to remember the pictures (see Appendix D).

In an effort to reduce error in measurement the testing conditions were held constant in the linear and the multiple image presentations. In each testing condition, the same room, lighting, distance of projectors from the screens, and seating arrangement were used. Instructions which were given to the subjects were read from a script so that each group received the same instructions; a copy of the instructions is enclosed in Appendix C.

A correct response in the experiment was the selection of the

criterion picture from the group of three similar pictures. There were twenty (20) items on the test and two practice items. The score for each subject was the number of correct responses on the test (0-20).

Statistical Design

A 2 X 2 factorial analysis of variance was utilized to test the three hypotheses:

H₀1: There is no difference between Visuals and Haptics in a visual location task.

H₀2: There is no difference between multiple and linear imagery in a visual location task.

H₀3: There is no interaction of perceptual type and presentation mode in a visual location task.

In the event of an interaction, four (4) additional hypotheses would be examined to determine the simple effects:

H₀4: There is no difference in the scores made by Haptics with multiple and linear imagery.

H₀5: There is no difference in the scores made by Visuals with multiple and linear imagery.

H₀6: There is no difference in the scores made by Visuals and Haptics with multiple imagery.

H₀7: There is no difference in the scores made by Visuals and Haptics with linear imagery.

The dependent variable was the score on the experimental task. The independent variables were presentation mode (linear and multiple imagery) and perceptual type (Haptic and Visual). Figure 4 illustrates

Figure 4. Illustration of the 2 X 2 Factorial Design

the design of the study. The .05 significance level was set to reject or accept as tenable for each of the hypotheses.

Summary

This chapter presented the research methodology and procedures used to examine the relationship of perceptual type (Haptic and Visual) and presentation mode (multiple and linear imagery) in a visual location task.

The perceptual type of two hundred (200) students was determined through the administration of two tests. Forty (40) Haptics and forty (40) Visuals were selected and randomly assigned to treatment groups. Two groups each of twenty (20) Haptics and twenty (20) Visuals received the multiple image presentation; two groups each of twenty (20) Haptics and twenty (20) Visuals received the linear image presentation.

Subjects were required to view three black and white 2X2 35mm slides representing three quadrants of a criterion picture. The experimental task was to select the criterion picture from a group of three similar pictures. Additional data relating to the subjects' methods of remembering the pictorial detail was collected.

A 2 X 2 factorial analysis of variance was selected to analyze the data. The results and findings were presented in Chapter 4.

Chapter 4

DATA ANALYSIS

The purpose of this chapter was to present the results of the analysis of data as presented in Chapter 3. The .05 significance level was adopted for the test of the hypotheses.

The dependent variable used in this study was the number of correct responses on a visual location task (see Appendices F and G). The independent variables were presentation mode (linear and multiple imagery) and perceptual type (Haptic and Visual). Table 1 illustrates the mean scores for each of the treatment combinations.

Primary Analyses

A summary table of the factorial analysis of variance based on the means shown in Table 1 was presented in Table 2. All three F-ratios were significant at the .05 probability level. The significant F-ratio for the interaction argues against a direct interpretation of the main effects. Figures 5 and 6 illustrate the interaction. From these graphs of the interaction, it can be seen that:

1. Visuals scored higher than Haptics with both multiple and linear imagery.
2. Haptics scored higher with multiple imagery than with linear imagery.
3. Visuals scored slightly higher with linear imagery than with multiple imagery.

Table 1
Illustration of Cell Means

	Multiple Imagery	Linear Imagery	Total
Haptic	13.05	10.1	11.58
Visual	15.05	15.38	15.22
Total	14.05	12.74	

n=20 per cell

Table 2
Summary Table for Analysis of Variance

Source of Variance	Sum of Squares	DF	Mean Square	F
Presentation Mode (Multiple and Linear)	26.45	1	26.45	6.655*
Perceptual Type (Haptic and Visual)	288.8	1	288.8	72.709**
Presentation Mode and Perceptual Type Interaction	64.8	1	64.8	16.314**
Within	301.9	76	3.972	
Total	681.95	79		

* P < .05
**P < .01

Figure 5. Interaction of Presentation Mode and Perceptual Type

Figure 6. Interaction of Presentation Mode and Perceptual Type

Table 3
Analysis of Variance for Simple Effects

Source of Variance	Sum of Squares	DF	Mean Square	F
Presentation Mode for Haptics	87.025	1	87.025	21.91*
Presentation Mode for Visuals	4.225	1	4.225	1.064
Perceptual Type for Multiple Imagery	40.0	1	40.0	10.07*
Perceptual Type for Linear Imagery	313.6	1	313.6	78.95*
Within	301.9	76	3.972	

* $P < .01$

Secondary Analyses

When there is an interaction, the magnitude and direction of one main effect depends upon the level of the other main effect. Because of the interaction in this study, it was necessary to interpret the main effects by examining comparisons between each main effect at a specific level, ie., the simple main effects. Therefore, additional null hypotheses were generated to test the significance of the simple main effects:

H_{04} : There is no difference in the scores made by Haptics with multiple and linear imagery.

H_{05} : There is no difference in the scores made by Visuals with multiple and linear imagery.

H_{06} : There is no difference in the scores made by Visuals and Haptics with multiple imagery.

H_{07} : There is no difference in the scores made by Visuals and Haptics with linear imagery.

Discussion of these additional hypotheses follow, using the F-test and a significance level of .01. The higher significance level was adopted as a more conservative test since all of these multiple analyses are based on the same group of subjects. A summary table of the analysis of variance for the simple main effects based on the means in Table 1 is presented in Table 3.

The significant F-ratios led to the rejection of three of the hypotheses:

H_{04} : There is no difference in the scores made by Haptics with multiple and linear imagery.

H_0 6: There is no difference in the scores made by Visuals and Haptics with multiple imagery.

H_0 7: There is no difference in the scores made by Visuals and Haptics with linear imagery.

The remaining hypothesis for simple effects was not rejected:

H_0 5: There is no difference in the scores made by Visuals with multiple and linear imagery.

Presentation of Additional Data

Goodness of fit. The results of the chi square test for goodness of fit on the obtained distribution of perceptual types (Visuals, 38%; Haptics, 35%; and Indefinites, 27%) showed a significant difference from the theoretical distribution described by Lowenfeld (Visuals, 50%; Haptics, 25%; and Indefinites, 25%). Table 4 presents the summary of this data.

Remembering pictorial detail. Data was obtained to determine the method used by students to remember visual detail and is illustrated in Appendix H. A summary of this data is provided below each described method:

1. I tried to pick out one specific detail and remember it.

Seventy-one (71) subjects reported that they relied upon remembering one specific detail. Thirty-four (34) Haptics and thirty-seven (37) Visuals utilized this method.

2. I tried to visualize the outline of the pictures.

Sixteen (16) subjects reported that they tried to visualize the outline of the pictures. Eight (8) Haptics and eight (8) Visuals

Table 4
Chi Square Test for Goodness of Fit on
Obtained and Expected Distributions
of Perceptual Types

Perceptual Type	Expected N	Obtained N
Visual	100	76
Haptic	50	70
Indefinite	50	54
Total N= 200		
df= 2		
$\chi^2 = 14.08^*$		

*P < .05
*P < .001

used this method.

3. I silently described how a picture looked.

Twenty-one (21) students tried to remember pictorial detail by silently describing how a picture looked. Ten (10) were Haptics and eleven (11) were Visuals.

4. I tried to remember each detail.

Twelve (12) students tried to remember each detail of a picture. Nine (9) were Haptics and three (3) were Visuals.

5. Other method.

Six (6) students listed another method other than the four listed. The two (2) Haptics who listed another method both cited associating details with something they knew. Of the Visuals, two (2) listed that they tried to remember the angles of details, and two (2) responded that they tried to remember light and dark contrasts.

Summary

This chapter has presented the results from the data analysis of the relationship between perceptual type (Haptic and Visual) and presentation mode (linear and multiple imagery). The results indicated that:

1. There was an interaction of perceptual type and presentation mode.

2. There was a significant difference in the scores made by Haptics with multiple and linear imagery.

3. There was no significant difference in the scores made by Visuals with multiple and linear imagery.

4. There was a significant difference in the scores made by Visuals and Haptics with linear imagery.

5. There was a significant difference in the scores made by Visuals and Haptics with multiple imagery.

6. There was a significant difference between the observed population of perceptual types and the theoretical distribution of perceptual types.

7. Most students tended to select one specific detail to remember when trying to retain pictorial detail.

Chapter 5 will present the summary, conclusions, and recommendations for further research.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

FOR FURTHER RESEARCH

In recent years the field of educational media has attempted to develop an empirical base which considers the interaction of the components of unique medium-message characteristics, learner characteristics, and psychological requirements of the learning task. This study added to the empirical base for multiple imagery, perceptual types, and visual location tasks.

SUMMARY

Purpose of study

The purpose of this study was to determine the relationship between perceptual type (Haptic and Visual) and presentation mode (Multiple and linear imagery) in a visual location task. Specifically, the purpose was to answer the questions:

1. Is there a difference between Visuals and Haptics in a visual location task?
2. Is there a difference between multiple and linear imagery in a visual location task?
3. Is there an interaction between perceptual type and presentation mode in a visual location task?
4. Is there a difference in the scores made by Haptics with multiple and linear imagery?
5. Is there a difference in the scores made by Visuals with multiple

and linear imagery?

6. Is there a difference in the scores made by Visuals and Haptics with multiple imagery?

7. Is there a difference in the scores made by Visuals and Haptics with linear imagery?

Procedure

The visual task in this study required subjects to view three black and white 35mm slides which represented three quadrants of a criterion picture. Subjects were to select the criterion picture when they were shown three similar pictures. Two groups viewed the quadrant slides in a linear image presentation, and two groups viewed the quadrant slides in a multiple image presentation. There were twenty (20) items on the test. Based on the results from the pilot study, the test was judged to be of appropriate difficulty to meet the needs of the study.

The perceptual type of two hundred (200) community college students was determined through two tests developed by Lowenfeld. Students who were classified as Visual on both tests were designated Visual; students who were classified Haptic on both tests were designated Haptic. Forty (40) Haptics and forty (40) Visuals were selected and randomly assigned to treatment groups. Two groups each of twenty (20) Haptics and twenty (20) Visuals received the linear image presentation; two groups each of twenty (20) Visuals and twenty (20) Haptics viewed the multiple image presentation.

In the linear presentation, students saw three quadrants of the

criterion picture one at a time projected by a single carousel projector. In the multiple image presentation, students saw the three quadrants of the criterion picture at the same time, projected simultaneously by three separate projectors. For each of the presentations the three similar pictures, one of which was the criterion picture, were projected simultaneously by three separate carousel projectors.

Prior to the testing sessions the projectors and screens were placed in the testing room and adjusted for proper projection. The testing sessions for all four groups were conducted in the same room. A nine minute period of time was used for each presentation.

A series of questions concerning the technique utilized by students to remember visual detail was administered following the treatment. The statistical treatment, analysis of variance, was employed to test for significant differences between the means of the various groups.

Results

The following results were obtained upon completion of statistical analysis of the data:

1. There was an interaction of presentation mode and perceptual type in a visual location task.

2. There was a significant difference in the scores made by Haptics with multiple and linear imagery. Haptics scored higher with multiple imagery than with linear imagery.

3. There was no significant difference in the scores made by

Visuals with multiple and linear imagery. Though there was no significant difference, Visuals scored higher with linear imagery than with multiple imagery.

4. There was a significant difference in the scores made by Visuals and Haptics with multiple imagery. Visuals scored higher than Haptics with multiple imagery.

5. There was a significant difference in the scores made by Visuals and Haptics with linear imagery. Visuals scored higher than Haptics.

6. There was a significant difference between the obtained distribution of perceptual types and the theoretical distribution established by Lowenfeld.

7. The technique utilized by most students to remember visual detail involved selecting one specific detail to remember.

Conclusions

The findings of this study support the following conclusions as to the relationship of perceptual type and presentation mode in a visual location task:

1. The results of this study indicated that there was an interaction of perceptual type and presentation mode. A study by Ausburn (F. B., 1975) is in agreement with the findings of this investigation. Examination of the interaction tended to show that the difference between multiple and linear imagery was significant for Haptics. Haptics tended to score higher with a multiple image presentation

than with a linear image presentation. There was no difference in presentation mode for Visuals; Visuals tended to score the same in the linear image presentation as in the multiple image presentation. The multiple image presentation, however, tended to show that Visuals scored higher than Haptics.

Previous studies (Lowenfeld, 1939, 1945; Ausburn, L. M., 1975; Ausburn, F.B., 1975, 1976; Howell, 1972; Lovano, 1970; Grossman, 1970) have indicated a difference between Visuals and Haptics. However, the study by Ausburn (F. B., 1976), which was a comparative visual location task, was the only study that utilized multiple and linear imagery. Previous research comparing multiple and linear imagery tended to produce conflicting results. Some investigations (Reid, 1970; Lombar, 1969) showed superiority of multiple imagery. Others (Didcoct, 1972; Fradkin, 1971) indicated no difference between multiple and linear imagery, while still others (Fradkin, 1974) indicated superiority of linear imagery. These conflicting results may have been due to the fact that the studies did not account for differences in perceptual type. Therefore, from the findings in this study, it may be concluded that linear imagery is effective for Visuals while multiple imagery is effective for both Visuals and Haptics in a visual location task.

It can be inferred from the results of this study that the multiple image presentation tended to facilitate the comprehension, retention, and utilization of visual cues. Thus supplantation appeared to have occurred. Since supplantation is an internal process, its presence can only be surmised as a result of the improved performance

by Haptics with multiple imagery.

The implications of the results of this study are that the design of media should include consideration of perceptual types, particularly at the community college level. For visual students, the presentation mode does not appear to make a difference. However for Haptics, multiple image presentations appear to be a way in which instruction can be effectively presented.

2. Analysis of the data for goodness of fit of perceptual types indicated a significant difference between the observed perceptual types and the theoretical distribution. Previous research by Howell (1970), Ausburn (L. J., 1975) and Ausburn (F. B., 1975, 1976) tended to support the theoretical distribution determined by Lowenfeld (1945). This study does not support the previous research. The important difference found in this study was that greater numbers of Haptic students and fewer numbers of Visual students were identified in this particular community college sample. It can be concluded that the population used in this study is different from the greater population in relation to the number of Haptics versus Visuals.

It should be noted that previous studies involving perceptual type did not use community college students as subjects. Community colleges may tend to attract more Haptic students than other institutions. Because Haptics rely on their physical world, more Haptics may tend to select community colleges because of their vocational orientation. Areas of study involving the physical world would logically appeal to Haptics. Because of the open door admissions

policy of community colleges, many students who do not have a history of high achievement elect to attend a community college. Since studies by Erickson (1964, 1967, 1969) and Todd (1976) have indicated that Haptics tend to have lower achievement levels than Visuals, it would seem logical to expect greater numbers of Haptic students in community colleges. While this study did not consider achievement, the obtained data, ie., the scores on the experimental task, would support the belief that Haptic students would attain lower achievement levels than Visuals, where there were predominant sequential or linear forms of instruction. Furthermore, the data from this study indicated the existence of one Haptic for every three students. Knowledge of this distribution should be particularly accounted for by both media designers and instructors. The method of presentation may be the crucial factor in facilitating the learning process for Haptics.

It is also possible that the reason for finding disproportionate numbers of perceptual types was that Lowenfeld's tests did not adequately discriminate between perceptual types. Lowenfeld's tests have been used for many years; however, the author has not been able to establish a correlation between the results of the tests. Nevertheless, the individual tests appear to be able to classify persons with similar attributes.

3. The data from the student responses indicated that students tended to select one specific detail when they attempted to remember the visual information. While no statistical analysis was employed relative to this data, the investigator feels that the use of this

technique may have implications for the use of visual materials. No matter how the visual information was presented, subjects selected only a portion of detail to remember. Informal discussion with students led the experimenter to believe that students selected detail to remember which they could relate to and put into their own cognitive structure. It would appear that Haptics were better able to establish relationships between the parts in the multiple image presentation than in the linear image presentation.

Discussion

Even though this study indicated highly significant results, a degree of skepticism must be interjected. Realizing the bandwagoning which has characterized educational approaches in the past, this author wishes to emphasize the caution with which the results should be taken. These cautions and skepticisms can be viewed as interpretation through a knowledge of the study. First of all, the tests for determining perceptual type may be deficient. To give greater power to the tests, appropriate covariates such as short-term memory or achievement need to be used. In this way, the attributes being investigated can be more nearly determined.

Additionally, the reliability and validity of the experimental testing instrument need to be improved before broader generalizations can be made. To this end, increasing the number of items on the test would be appropriate. Likewise, the task itself should be examined so that the inherent qualities of multiple imagery can be best utilized.

Finally, a realistic approach to mainstreaming application into the "real world" needs to be addressed. Ideally, we need to determine the optimum learning style for all students for particular learning tasks. In order to attain this, it will be necessary to educate instructors, administrators and instructional designers as to the potential divergent learning styles, especially Haptics in the community colleges.

At the point where this research has been replicated and improved, then conclusions can be drawn which are more broadly applicable. The conclusions of this study must be considered tentative, though encouraging. It is most importantly hoped that this study will serve as a springboard for further research to add to the empirical evidence relative to aptitude-treatment interaction.

Recommendations for Further Research

The purpose of this study was to determine the relationship between perceptual type (Haptic and Visual) and presentation mode (multiple and linear imagery). The results indicated that there was an interaction of perceptual type and presentation mode. There was no significant difference between multiple and linear imagery for Visuals; Haptics scored significantly higher with a multiple image presentation than with a linear image presentation. In both presentations, Visuals scored significantly higher than Haptics.

Based on the findings and procedures of this study, the following recommendations are made:

1. Additional investigations of the relationship of perceptual

type and presentation mode should be conducted, utilizing larger samples in other community colleges to verify the findings of this study.

2. Instruments to determine perceptual type need to be examined to ascertain accuracy in discrimination between perceptual types.

3. Additional items should be included in this test to increase the reliability. While the reliability estimate on the pilot test was .71, the reliability estimate of the experiment was .58.

In order to refine and further substantiate the findings of this study, the additional recommendations are made:

4. Additional variables such as achievement or memory should be investigated in relation to the dependent variables used in this study.

5. Additional studies should investigate other viewing time intervals.

6. A different method of dividing the criterion picture should be investigated, such as a sequential progression from left to right.

Determination of utilization strategies of findings from this study could be enhanced by the following:

7. Studies should be conducted to investigate situations where knowledge of perceptual type is crucial.

8. Additional studies should be made to establish conditions or subject matter where multiple imagery should be utilized.

9. Studies should be conducted to examine the pairing of perceptual type with method of instruction.

10. Community colleges need to be made aware of the presence of large numbers of Haptic students.

11. Instructors need to be made aware of the Visual-Haptic abilities.

12. Instructional designers need to incorporate knowledge of perceptual type, learning tasks, and presentation mode as they design materials, particularly for community college students.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Adhemar, J. Twentieth-Century graphics. New York: Praeger Publishers, 1971.
- Allen, W.H. Research on educational media. In James W. Brown (Ed), Educational Media Yearbook. New York: R.R. Bowker Co., 1974.
- _____ & Conney, S.M. A study of the non-linearity variable in filmic presentation. Los Angeles: University of Southern California, 1963. NDEA Title VII, Project No. 422.
- Attneave, F. Some informational aspects of visual perception. Psychological Review, 1954, 61, 183-193.
- Ausburn, F.B. Multiple versus linear imagery in the presentation of a comparative visual location task to visual and haptic college students. Unpublished doctoral dissertation, University of Oklahoma, 1975.
- Ausburn, L.B. The relationship of perceptual type to perceptual style and tempo in college students. Paper presented at the national convention of the Association for Educational Communications and Technology, Dallas, Texas, April 13-17, 1975. (ERIC Document Reproduction Service N., ED 101 726)
- Ausubel, D.P. Educational psychology: A cognitive view. New York: Holt, Rinehart and Winston, 1968.
- Barr, C. Cinemascope: Before and after. Film Quarterly, 1963, 16(4), 4-24.
- Bazin, G. The history of world sculpture. Weert, The Netherlands: Lamplight, 1968.
- Berlyne, D.E. Structure and direction in thinking. New York: John Wiley, 1965.
- Blackwell, N.R. Vision engineering. Lighting, July, 1963, 38-43.
- Bloomer, R.H. Children's preferences and responses as related to styles and themes of illustrations. Elementary School Journal, 1955, 19, 367-371.
- Cornwell-Klyne, A. 3-D cinematography and new screen techniques. New York: Hutchinson's Scientific and Technical Publications, 1954.
- Davies, K. and Bloom, E. Painting sharp focus still lifes. New York: Watson-Guptill, 1975.

- Dennis, J.M. Grant Wood: A study in American art and culture. New York: Viking Press, 1975.
- Didcoct, D.H. Comparison of the cognitive and affective responses of college students to single-image and multi-image audio-visual presentations. Unpublished doctoral dissertation, Cornell University, 1958.
- Dwyer, F.M. A guide for improving visualized instruction. State College, Pa.: Learning Services, 1972.
- Eisner, E.W. Educating artistic vision. New York: Macmillan, 1972.
- Elkind, D., Kogler, R., and go, E. Studies in perceptual development: II Part-whole perception. Child Development, 1964, 35, 81-90.
- Erickson, R.C. Visual-haptic aptitude: Effect on student achievement in reading. Journal of Learning Disabilities, 1969, 2, 21-25.
- _____. Visual-haptic aptitude: effect on mechanical drawing achievement. Journal of Industrial Teacher, 1964, 2, 40-46.
- _____. Visual-haptic aptitude: effect on student-teacher interaction and mechanical drawing achievement. Journal of Industrial Teacher Education, 1967, 4, 48-55.
- Eysenck, N.J. The measurement of motivation. Reprinted from Scientific American. May, 1963. W.H. Freeman and Company, print no. 477.
- Ferguson, G.A. Statistical analysis of psychology and education, New York: Mc-Graw-Hill, 1971.
- Flick, P. Ten tests of the visual-haptic aptitude. Studies in Art Education, Spring, 1962.
- Fradkin, B.M. An investigation of the effects of multi-image stimuli on later recall of tenth grade students. Unpublished doctoral dissertation, University of Pittsburg, 1971.
- _____. Effectiveness of multi-image presentations. Journal of Educational Technology Systems, 1974, 2, 321-326.
- _____. & Meyowitz, J. Design of multi-image instructional presentations. Paper presented at the national convention of the Association for Educational Communications and Technology, Dallas, Texas, April 13-17, 1975.

- French, J.E. Children's preferences for pictures of varied complexity of pictorial pattern. Elementary School Journal, 1952, 53, 381-385.
- Gagne, R. Conditions of learning. New York: Holt, Rinehart & Winston, 1965.
- Gentile, T.R., Kessler, D.K., & Gentile, P.K. Processing of solving analogy items. Journal of Educational Psychology, 1960, 6, 494-503.
- Hartman, F.R. Single and multiple channel communication: A review of research and a proposed model. A V Communication Review, 1961, 9, 235-262.
- Howat, J.K. The Hudson River and its painters. New York: Viking Press, 1972.
- Howell, A.D. An electroencephalographic comparison of Lowenfeld's haptic-visual and Witkin's field-dependent-field-independent perceptual types. Unpublished doctoral dissertation, Ball State University, 1972.
- Hubbard, R.D. TeleMation: A V automatically controlled. Audiovisual Instruction, 1961, 6, 437-439.
- Kleinsmith, L.J., & Kaplan, S. Paired-associate learning. Journal of Experimental Psychology, 1964, 67, 124-126.
- _____. Interaction of arousal and recall interval in nonsense syllable paired-associate learning. Journal of Experimental Psychology, 1964, 67, 124-126.
- _____. & Tarte, R.D. The relationship of arousal to short- and long-term verbal recall. Canadian Journal of Psychology, 1963, 17, 393-397.
- Langer, S.D. Philosophy in a new key: A study of the symbolism of reason, rite, and art. Cambridge: Harvard University Press, 1957.
- Leonard, K. Pablo Picasso: Recent etchings, lithographs, and linoleum cuts. New York: Harry N. Abrams, Inc., 1966.
- Levy, J. Arshile Gorky. New York: Harry N. Abrams, Inc., nd.
- Lindemann, G. Prints and drawings. New York: E.P. Dutton, 1970.
- Lipman, J.H. and Winchester, A. Primitive painters in America. New York: Dodd Mead and Company, 1950.

- Loftus, G.R. Eye fixations and recognition memory for pictures. Cognitive Psychology, 1972, 3. 521-551.
- Logan, H.L. Brightness and illumination requirements. The motion picture theatre. New York: Society of Motion Picture and Television Engineers, 1948.
- Lombard, E.S. Multi-channel, multi-image teaching of synthesis skills in eleventh grade United States history. Unpublished doctoral dissertation, University of Southern California, 1969.
- Lovano, J.J. The relation of conceptual style and modes of perception to graphic expression. Studies in Art Education, Spring 1970, 11, 39-49.
- Low, C. Multi-screen and Expo '67. Journal of the Society of Motion Picture and Television Engineers, 1968, 77, 185-186.
- Lowenfeld, V. The nature of creative activity: Experimental and comparative studies of visual and non-visual sources. New York: Harcourt, Brace, 1939.
- _____. Tests for visual and haptic aptitudes. American Journal of Psychology, 1945, 58, 100-112.
- _____. Creative and mental growth. New York: Macmillan Company, 1957.
- _____. & Brittain, W.L. Creative and mental growth. (5th ed.) New York: Macmillan Company, 1970.
- May, M.A. & Lumsdaine, A.A. Learning from films. New Haven: Yale University Press, 1958.
- McFee, J.K. Visual communication. In R.V. Wiman & W.C. Meierhenry (eds.) Educational media: Theory into practice. Columbus, Ohio: Charles E. Merrill, 1969.
- McWhinnie, H.J. A review of recent literature in perceptual/cognitive style with implications for theory and research in art education. Studies in Art Education, Spring 1970, 11.
- Millard, W.L. Visual teaching aids: Production and use. The encyclopedia of photography. New York: The Grey-Stone Press, 1964.
- Miller, W.A. What children see in pictures. The Elementary School Journal, 1938, 38, 676-682.

- Nickerson, R.S. Short-term memory for complex meaningful visual configurations: A demonstration of capacity. Canadian Journal of Psychology, 1965, 19, 155-160.
- Perrin, D.G. A theory of multiple-image communication. A V Communication Review, 1969, 23, 368-382.
- Pillsbury, J.A. EEG correlates of perceptual style: field orientation. Psychomatic Medicine, 1967, 24, 441-49.
- Potter, M.C. & Levy, E.I. Recognition memory for a rapid sequence of pictures. Journal of Experimental Psychology, 1969, 81, 10-15.
- Reid, R.O. A comparison of a multi-image and a linear film format as agents of attitude change. Unpublished doctoral dissertation, Syracuse University, 1970.
- Reeves, D.J. The assessment of altered differentiation as affected by experimental art methodologies. Doctoral dissertation reported at the National Art Education Association Convention Dallas, April 6, 1971.
- Ryan, T.A. & Hochberg, C.B. Speed of perception as a function of mode of presentation. Unpublished manuscript. Cornell University, 1954.
- _____ & Schwartz, C.B. Speed of perception as a function of mode of presentation. American Journal of Psychology. 1956, 69, 60-69.
- Salomon, G. What does it do to Johnny: A cognitive-functionalistic view of research on media. Viewpoints (Bulletin of the School of Education, Indiana University) 1970, 46, 33-63.
- Schlanger, B. Criteria for motion picture viewing and for new 70 mm system: Its process and viewing arrangements. Journal of the Society of Motion Picture and Television Engineers, 1966, 75, 161-167.
- Sheaks, B. Painting with acrylics from start to finish. Worcester, Massachusetts: Davis Publications, 1972.
- Shepard, R.N. Recognition memory for words, sentences, and pictures, Journal of Verbal Learning and Verbal Behavior, 1967, 6, 156-163.
- Smith, R.L. Monotony and motivation: A theory of vigilance. Santa Monica, California: Dunlap and Associates, 1966.
- Spaulding, S. Communication potential of pictorial illustration. A V Communication Review, 1956, 4, 31-46.

- Standing, L., Conezio, J., & Haber, R.N. Perception and memory for pictures: Single trial learning of 2500 visual stimuli. Psychonomic Science, 1970, 19, 73-74.
- Steig, W. The lonely ones. New York: Duell Sloan and Pearce, 1942.
- Stuart, I.R. The question of constitutional influence on perceptual style. Perceptual and Motor Skills, 1965, 20.
- Sullivan, E. Acquisition of conservation of substance through films modeling techniques. In D. Brison & E. Sullivan (Eds.), Recent research on the acquisition of substance (Educational Research Series No. 2). Ontario: Ontario Institution for Studies of Education, 1967.
- TerLouw, A.L. Legibility standards for projected material. Address before the Indiana State Conference on School Planning and Audio-Visual Education, Bloomington, Indiana, 1956.
- Travers, R.M.W. The design of pictures for teaching children in elementary school. A V Communication Review, 1970, 18, 49-50.
- _____. Studies related to the design of audiovisual teaching materials. Final Report, May, 1966. Office of Education Contract No. 3-20-003, United States Department of Health, Education and Welfare.
- _____. A study of the advantages and disadvantages of using simplified visual presentations in instructional materials. Final Report on USOE Grant No. OEG-1-7-070144-5235, 1969.
- _____. Theory of perception and the design of audio-visual materials. Paper presented at the seminar on Educational Media sponsored by Bucknell University and U.S. Office of Education, Lewisburg, Pennsylvania, 1968.
- United States Army. Training by television and television prompting equipment. New York: Redstone Arsenal, Ordnance Guided Missile School, February 18, 1959.
- United States Army Air Corps, Psychological Testing Division, 1944. Successive Perception Test I. (Film)
- Valsecchi, M. Landscape painting of the 19th century. Greenwich, Connecticut: New York Graphic Society Ltd., 1971.
- VanderMeer, A.W. Relative effectiveness of color and black and white in instructional films. Port Washington, New York: Office of Naval Research, Human Engineering Division, Special Devices Center, 1951. Technical Report No. SDC-269-7-28.

- Walter, W.G. The living brain. New York: W.W. Norton and Company, 1953.
- Werner, A. Degas Pastels. New York: Watson-Guption Publications, 1968.
- Witkin, H.A. The effects of training and of structural aids on performance in three tests of space orientation. Report No. 80, Division of Research, CAA, Washington, D.C.
- _____. et al. Personality through perception. New York: Harper and Brothers, 1959.
- _____. Psychological differentiation. New York: John Wiley and Sons, 1962.
- _____. Psychological differentiation and forms of pathology. Journal of Abnormal Psychology, 1965, 70, 317-336.
- _____. Stability of cognitive style from childhood to young adulthood. Journal of Personality and Social Psychology, 1967, 7, 291-300.
- _____. A manual for the embedded figures test. Palo Alto, California: Consulting Psychologists Press Inc., 1971.

APPENDICES

APPENDIX A

LOWENFELD'S VISUAL-HAPTIC WORD ASSOCIATION TEST

Name _____

LOWENFELD'S VISUAL-HAPTIC WORD ASSOCIATION TEST

Beside each word given below, write your immediate reaction to it. Please write your first impression.

greeting _____

walking _____

looking _____

climbing _____

talking _____

lifting _____

thinking _____

drawing _____

catching _____

hearing _____

pulling _____

swimming _____

riding _____

running _____

jumping _____

listening _____

reaching _____

touching _____

stretching _____

breathing _____

APPENDIX B
EXPERIMENTAL TASK ITEMS

Item 1. Paul Seifert, Jacob Bennett Farm, Gotham, Wisconsin
Paul Seifert, Residence of Mr. E. R. Jones, Dodgeville, Wisconsin
Paul Seifert, Residence of Lemuel Cooper, Plain, Wisconsin

Item 2. Arshile Gorky, Delicate Game
Arshile Gorky, Drawing
Arshile Gorky, The Unattainable

- Item 3. Edgar Degas, Before the Exam (The Dancing Class)
Edgar Degas, Before the Exam
Edgar Degas, Ballet Dancers in the Wings

Item 4. Joseph Hidley, Poestenkill, New York, Summer
Joseph Hidley, West Sand Lake
Joseph Hidley, Glass House Lake

- Item 6. Willliag Steig, Why Pick on Me?
William Steig, Forgive Me--I'm Only Human
William Steig, Very Few Understand My Works

- Item 7. Pablo Picasso, Women of Algiers. Second variation,
fourth state. 17 March 1955.
Pablo Picasso, Women of Algiers. Second variation,
second state. 7 March 1955.
Pablo Picasso, Women of Algiers. Second variation,
fourth state. 5 February 1955

Item 8. Ken Davies, Speed Painting, Exercise 7,
completed third quarter
Ken Davies, Speed Painting, Exercise 7,
completed first quarter
Ken Davies, Speed Painting, Exercise 7
completed fourth quarter

Item 9. Pablo Picasso, The Kill (Estocada)
Pablo Picasso, Matador Thrown by the Bull
Pablo Picasso, Just Before the Kill

- Item 10. Ken Davies, Gray's Spoons, Scrumbling
Ken Davies, Gray's Spoons, Glazing
Ken Davies, Gray's Spoons, Block-in of Back wall of Cabinet

Item 11. Grant Wood, Fall Plowing
Grant Wood, Young Corn
Grant Wood, Stone City

- Item 12. Ken Davies, Still Life Under Green Light, wash-in
Ken Davies, Still Life Under Green Light, block-in
Ken Davies, Still Life Under Green Light, completed painting

- Item 13. Head of a Youth, from Anetkythera. Bronze. Greek.
Female Head, from the west pediment of the Heraion
at Argos. Greek.
After Skopas. Head of Meleager. Roman.

Item 14. Pablo Picasso, In the Studio IV. 13 March 1965.
Pablo Picasso, In the Studio IV. 12 March 1965.
Pablo Picasso, In the Studio III. 12 March 1965.

Item 15. Pablo Picasso, Large Head of Woman With Hat
Pablo Picasso, Large Head of Women With Decorated Hat
Pablo Picasso, Woman's Head

Item 16. Marc Chagal, Moses
Marc Chagal, Das Paar
Marc Chagal, Der Knabe

Item 17. Grant Wood, Sheltered Spot, Kenwood
Grant Wood, Leaning Trees
Grant Wood, Trees and Hill, Oaks

Item 18. Arshile Gorky, Composition
Arshile Gorky, Painting
Arshile Gorky, Xhorkom

Item 19. Grant Wood, Coppersmith
Grant Wood, Turret Lathe Operator
Grant Wood, Coil Welder

Item 20. Ken Davies, On 139 Near 80, branches and
water-pump detailed
Ken Davies, On 139 Near 80, barn completed,
silo blocked-in
Ken Davies, On 139 Near 80, barn dry-brushed

APPENDIX C
INSTRUCTIONS

INSTRUCTIONS

"First of all, I would like to thank you all for participating in this experiment.

I am going to ask you to view some slides that are a portion of a picture and then select that picture from a group of three similar slides. Let me demonstrate. (Slide one, slide two, slide three.) You have just seen three quadrants, or parts, of a picture. Now I'll show you the three similar pictures (slide four, slide five, slide six). You are to select which of these pictures is the one that you just saw the three parts of. You probably could tell that the first picture is the correct answer.

Please look at your answer sheet and notice that there are twenty (20) items on the test. You are to circle your answer on the sheet. If your answer is the picture projected on this far left screen (indicate screen), circle first; if your answer is the picture projected on this middle screen (indicate screen), circle second; and if your answer is the picture on this right screen (indicate screen), circle third. I will announce each item and tell you when to mark your answers. Okay. Let me give you another example before we begin. This time you will see the slides for a shorter period of time. There will be a short time between the two sets of slides. Pay attention, because the slides will be projected for just a moment. (Slides seven--twelve.) You could probably tell that the correct answer was in the middle, or the second picture. Are there any questions? Okay, let's begin.

(Nine minutes later.) Thank you very much. Before you leave, I'd like for you to do one more thing. I'm going to give you another sheet of paper with some questions regarding how you attempted to remember the information that you saw. (Give out questions.) Please mark the appropriate response or responses. If you use a technique that is not listed, please describe your technique. When you have finished, give the two answer sheets to me as you leave.

APPENDIX D

QUESTIONS RELATIVE TO PICTORIAL STYLE

Please indicate the technique you used to remember the pictorial information on this test. If you used a technique that is not listed, please describe your technique. You may check more than one response.

_____ 1. I tried to pick out one specific detail and remember it.

_____ 2. I tried to visualize the outline of the pictures.

_____ 3. I silently described how a picture looked.

_____ 4. I tried to remember each detail.

_____ 5. Other method. (Please describe.) _____

APPENDIX E
RESPONSE SHEET

1.	1st	2nd	3rd
2.	1st	2nd	3rd
3.	1st	2nd	3rd
4.	1st	2nd	3rd
5.	1st	2nd	3rd
6.	1st	2nd	3rd
7.	1st	2nd	3rd
8.	1st	2nd	3rd
9.	1st	2nd	3rd
10.	1st	2nd	3rd
11.	1st	2nd	3rd
12.	1st	2nd	3rd
13.	1st	2nd	3rd
14.	1st	2nd	3rd
15.	1st	2nd	3rd
16.	1st	2nd	3rd
17.	1st	2nd	3rd
18.	1st	2nd	3rd
19.	1st	2nd	3rd
20.	1st	2nd	3rd

AGE _____

SEX _____

CURRICULUM _____

GPA _____

APPENDIX F

CORRECT RESPONSES BY SUBJECT PER ITEM

Correct Responses by Subject Per Item

Student Number	Haptic Linear	Student Number	Haptic Multiple	Student Number	Visual Linear	Student Number	Visual Multiple
1	7	21	8	41	16	61	16
2	7	22	8	42	13	62	14
3	11	23	12	43	15	63	15
4	7	24	14	44	15	64	16
5	8	25	16	45	16	65	16
6	12	26	17	46	17	66	13
7	10	27	16	47	17	67	15
8	11	28	12	48	17	68	12
9	11	29	12	49	14	69	18
10	11	30	13	50	14	70	15
11	10	31	14	51	15	71	16
12	8	32	12	52	14	72	13
13	11	33	12	53	17	73	17
14	10	34	18	54	15	74	16
15	10	35	16	55	16	75	13
16	13	36	14	56	12	76	16
17	11	37	10	57	18	77	16
18	10	38	13	58	17	78	15
19	12	39	11	59	19	79	14
20	12	40	13	60	17	80	15

APPENDIX G

CORRECT RESPONSES BY ITEM PER SUBJECT

Correct Responses by Item Per Subject

Item Number	Haptic Linear	Haptic Multiple	Visual Linear	Visual Multiple	Total
1	12	16	17	16	61
2	11	16	19	19	65
3	17	13	18	16	64
4	7	14	17	15	53
5	9	13	15	15	52
6	16	15	20	20	71
7	5	11	13	14	43
8	14	18	18	18	68
9	9	14	12	16	51
10	4	3	7	10	24
11	16	16	19	16	67
12	5	4	9	9	27
13	7	17	15	16	55
14	12	17	17	17	63
15	9	16	16	19	60
16	6	6	15	7	34
17	13	14	18	14	59
18	6	5	15	12	38
19	14	19	20	18	71
20	8	14	14	15	51

APPENDIX H

TECHNIQUE USED BY SUBJECTS TO REMEMBER PICTORIAL DETAIL

VITA

Joanne Brown Whitley was born in Newport News, Virginia, on July 17, 1943. She attended the public schools in Mathews, Virginia, and was graduated from Mathews High School in 1961. She attended James Madison University in Harrisonburg, Virginia and received a Bachelor of Science degree in English in 1965.

She taught English at Thomas Eaton Junior High School in Hampton, Virginia, from 1965 to 1967. From 1967 to 1971 she served as English teacher at Middlesex High School, Saluda, Virginia. She also served as English teacher at the Richmond Hebrew Day School, Richmond, Virginia, from 1972 to 1974.

In January, 1975, the author entered graduate school at Virginia Polytechnic Institute and State University, Blacksburg, Virginia. She was awarded a Master of Arts in Curriculum and Instruction in 1976. The author continued her graduate studies at Virginia Polytechnic Institute and State University to work on her doctorate. While in graduate school she was appointed graduate teaching assistant in the College of Education's Self Instruction Curriculum Lab for one year and the Office of Student Teaching for one year.

Ms. Whitley is the mother of one daughter, Karin Cooksey. The author is currently employed as the Assistant Project Director for Special Services and Coordinator of the Open Study Lab at Wytheville Community College, Wytheville, Virginia.

A handwritten signature in cursive script that reads "Joanne B. Whitley". The signature is written in dark ink and is positioned at the bottom right of the page, above the page number.

THE EFFECTS OF PERCEPTUAL TYPE AND PRESENTATION MODE
IN A VISUAL LOCATION TASK

by

Joanne Brown Whitley

(ABSTRACT)

The purpose of this study was to determine the relationship between perceptual type (Haptic and Visual) and presentation mode (multiple and linear imagery) in a visual location task. Specifically, the purpose was to answer the questions:

1. Is there a difference between Visuals and Haptics in a visual location task?
2. Is there a difference between multiple and linear imagery in a visual location task?
3. Is there an interaction between perceptual type and presentation mode in a visual location?
4. Is there a difference in the scores made by Haptics with multiple and linear imagery?
5. Is there a difference in the scores made by Visuals with multiple and linear imagery?
6. Is there a difference in the scores made by Visuals and Haptics with multiple imagery?
7. Is there a difference in the scores made by Visuals and Haptics with linear imagery?

The perceptual type of two hundred (200) community college students was determined through two tests developed by Lowenfeld. Students who

were classified as Visual on both tests were designated Visual; students who were classified Haptic on both tests were designated Haptic. Forty (40) Haptics and forty (40) Visuals were selected and randomly assigned to treatment groups. Two groups each of twenty (20) Haptics and twenty (20) Visuals received the linear image presentation; two groups each of twenty (20) Visuals and twenty (20) Haptics viewed the multiple image presentation.

The visual task in this study required subjects to view three black and white 35 mm slides which represented three quadrants of a criterion picture. Subjects were to select the criterion picture when they were shown three similar pictures. In the linear presentation, students saw three quadrants of the criterion picture one at a time projected by a single carousel projector. In the multiple image presentation, students saw the three quadrants of the criterion picture at the same time, projected simultaneously by three separate carousel projectors. There were twenty (20) items on the test, which was developed by the experimenter from a series of art prints. A series of questions concerning the technique utilized by students to remember visual detail was administered following the treatment. A 2 X 2 factorial analysis of variance was used to analyze the data at the .05 and the .01 significance levels.

The results of the analysis of data indicated that there was an interaction between presentation and perceptual type in a visual location task. Examination of the interaction indicated that the difference between multiple and linear imagery was significant for Haptics. Haptics tended to score higher with a multiple image presentation than with a

linear image presentation. There was no difference in presentation mode for Visuals; Visuals tended to score the same in the linear image presentation as in the multiple image presentation.

Other analyses indicated that there was a difference in the obtained perceptual types and the theoretical distribution described by Lowenfeld and others. It was concluded that community college students constituted a different population than the greater population, with more than the expected number of Haptics and fewer Visuals. Therefore it was suggested that instructional designers, instructors, and administrators consider the perceptual type of students when designing and implementing instruction. Multiple imagery may be the crucial factor in facilitating the learning process for Haptics.