# MENTAL IMAGERY AND LEARNING IN A COMMUNITY COLLEGE: A STUDY TO DETERMINE IF THE ABILITY TO IMAGE MENTALLY AFFECTS LEARNING FROM PICTORIAL OR VERBAL PRESENTATIONS

by

Patricia Ann Hunter

Dissertation submitted to the Graduate Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

in

Community College Education

APPROVED:

---
D. M. Moore, Chairman

---
D. S. Biskin

---
R. F. Steffen

---
M. C. Rockey

---
S. A. Tschumi

June, 1976

Blacksburg, Virginia

ACKNOWLEDGEMENTS

I am particularly grateful to the chairman of my doctoral committee, Dr. David Michael Moore, for his assistance, encouragement and guidance throughout my program of study and my dissertation. Without his continuous support this research would not have been completed.

I would also like to thank the members of my doctoral committee, Dr. Donald Biskin, Dr. Marybelle Rockey, Dr. Robert Steffen and Dr. Sally Tschumi, for their encouragement and assistance.

For their assistance in the statistical analysis of the results of the study, I would like to thank Dr. Dennis Hinkle, Dr. Raymond Myers and Ms. Sharon Crews.

I would like to thank the community college faculty who assisted me in preparing the study and particularly the students who participated in it.

To my many friends and relatives who provided emotional support during this time, I wish to express my gratitude.

Finally, a very special thank you is extended to my father and mother, without whose initial love, guidance, support, respect, sacrifice and encouragement, this endeavor would not have been possible.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF FIGURES

# Chapter 1

## INTRODUCTION

One of man's first recorded messages was a picture painted on the wall of a cave. The scene depicts a hunt either conducted by the unknown artist or observed by him. A written, verbal description of the painting is not required in order to establish the meaning of the picture; it is self-explanatory. Written communication was in the form of pictures until the development of an alphabet.

The scribblings known as writing did not become a form of communication until much later in man's development. These scribblings are abstract symbols, designed to impart a description about an item, event, person or action. The use of these scribblings eventually became widespread, and the use of pictorial representations as a form of communication declined.

The advent of movable type heralded the widespread use of the written word to communicate among educated, and usually wealthy, people. Subsequently, the written word was used to educate many groups, with pictures being used as a supplement to the written, abstract symbols or print. This trend in the decreased use of pictures as an educational tool seems to be reversed, with an increasing dissatisfaction with education which relies mainly on the printed word (Tanzman, 1972, p. 4). Even in higher education, the use of visuals is increasing (Bell, 1975).

The question then arises, do pictures and printed words

complement each other? Do they each serve as a useful component in the education and communication process? How does a person relate to a picture or the printed word, i.e., what meaning does he bring to them, in an educational setting? Just as people bring meaning to the scribblings known as words, they also bring meaning to pictures (Wendt, 1956, p. 286). These meanings are based on past and present experiences and education, stored in a person's memory, and recalled when required.

This recall can be in the form of mental pictures or images. When a person is trying to describe an object, he will often picture the object in his mind. He then describes it as he focuses his "mind's eye" on various characteristics of the object. The person is imaging, projecting a mental picture, in order to complete the description process. For example, if you ask someone how many windows he has in his home, he may mentally envision the outside of his home and proceed to count the windows. In this situation, the ability to project a vivid mental picture of the home provides a basis for answering the question correctly. This mental picture is known as an image, and the person is considered to have the ability to image.

Sometimes a mental image can be very clear, i.e., "I can see it as if it happened yesterday," or the image can be rather vague, i.e., "I can't quite see the details." A person's ability to image can range from low (usually very vague images) to high (usually very clear, precise images). The usefulness of this ability varies

according to how vivid the images are, (e.g., how many details are pictured), and how often the person uses his ability. Logically, someone who images very vividly would tend to use this ability more often than someone who images only vaguely.

Thinking involves more than one method of processing information, such as verbal language, and uses many symbolic representations, including imaging (National Society for the Study of Education [NSSE], p. 58). Therefore, consideration needs to be given to the use of imaging as a means of facilitating learning.

## Need for the Study

> Difficulties in determining the nature of the learner, learning stimuli and their interaction, and what specific learning results are achieved have precluded the development of anything approaching a science of instruction, (Moldstad, 1964, p. 389). However, a teacher should become aware of

variables which may affect a student's capacity for learning, so that those variables can be manipulated to provide for optimum learning. An instructor must capitalize on the skills of each individual and increase the potential for learning through those skills "that are to be used adaptively by the individual in countless different situations" (Smith and Smith, 1966, p. 469) throughout his life. Instruction should accommodate individual differences and provide different learning strategies (Roueche and Kirk, 1973, pp. 87-88).

Dealing with individual differences is particularly critical at the community college level, because of the usually high percentage of nontraditional students who require educational experiences

designed to meet their needs and overcome learning difficulties (Cross, 1971). Instruction tailored to an individual's requirements and skills should provide for maximum student involvement in learning (Roueche and Kirk, 1973, p. 89). Therefore, community colleges are concerned with experimentation and evaluation to devise appropriate and effective learning experiences (Cross, 1974, pp. 10-25). Effective learning experiences vary and could include a student's mentally projecting images of the information to be learned.

In view of the increasing use of visual presentations in higher education (Bell, 1975), further research is needed to determine the effectiveness of the use of visuals in presenting information and facilitating recall (Dwyer, 1975). In addition to research concerning the type of presentation, consideration should be given to an individual's abilities--as in this study, the ability to mentally image relationships in the information presented.

For example, if an individual can mentally formulate pictorial relationships, thereby increasing his retention and recall capabilities, this ability should be promoted as a learning skill. If the use of visual presentations enhances and increases this skill for the individual with high ability to image, then the continued use of visuals is suggested.

However, if the use of visuals reduces the effectiveness of this skill, the discontinuance of the visuals presentations may be recommended and alternative methods of presenting the material to be learned considered.

On the other hand, if a student has a lower ability to mentally image relationships, the use of visual presentations may supplement his skill and provide for greater retention and recall. If, however, the use of visual presentations does not promote retention and recall, other teaching methods must be utilized.

It is possible that visual presentations may promote learning in all levels of imagers; therefore, the use of visuals should be encouraged and increased. If the use of visuals does not promote learning in all cases, alternative methods should be considered before expending considerable time, effort and money on the mass production of such materials. Research can provide an indication of a possible better method of presentation.

## Purpose of the Study

The purpose of this study was to determine the effect of students' varying abilities to image upon their learning and their subsequent retention and recall of information. The study was to consider if learning was affected by the interaction of imagery ability and different presentations of information, namely pictorial and verbal. The study was designed to indicate possible answers to the following questions: If a person can project a clear mental image of information and is shown a picture of that information, is his recall and retention increased (the picture may enhance his image, adding memorable details) or decreased (the picture may counteract his image, creating confusion about the information to be remembered)? Also, if a student can project only a vague mental image of the

information and is shown a picture of the information, is his recall and retention increased or decreased?

In addition to testing this general reaction between imaging ability and presentation format, the study was to consider the relationship of academic aptitude to imaging ability and the effect of information concreteness or abstractness on recall and retention.

The following research questions were considered:

1. Does varying imagery ability affect how a person learns from pictures and/or the written word?

2. Is there a correlation between imagery ability and academic ability?

3. Does varying imagery ability affect learning of concrete or abstract material?

4. Does the means of presentation, pictorial or verbal, affect the learning of concrete or abstract material?

5. What effect does time have on the retention of these materials?

## Limitations

1. The study was conducted in one small, rural community college, and the results cannot be generalized to other institutions.

2. Students' scheduling and administrative procedure necessitated using members of intact class groups as subjects.

## Definitions

The following terms are defined for the context of this study:

Delayed retention. Recall capability after a period of time (2 weeks) beyond the original presentation of material.

Image and imagery. Nonverbal memory representations; nonverbal modes of thought.

Imaging. Mentally projecting a picture; picture may range from vague to vivid.

Mnemonic. Aiding memory.

Paired-associates or paired-association words. Stimulus-response words, i.e., students are presented with two words; in a recall situation, when presented with the first word, the student responds with the second word.

Pictorial presentation. A picture labeled with printed words.

Retention capability. The ability to recall the correct response when presented with a stimulus.

Verbal presentation. Printed word or words.

Visuals. Pictures.

## Overview

In subsequent chapters, specifics concerning this study are provided.

Chapter 2 is a review of related literature concerning the uses of imagery and the use of pictorial and/or verbal presentations of information.

Chapter 3 is a description of the research methodology including a description of the population and sample, test to measure imagery ability, preparation of the presentations, procedure of the experiment, conducting the experiment, analyses of the data, and the hypotheses.

The analysis of the data is included in Chapter 4.

Chapter 5 is the summary and discussion of the experiment and recommendations for further research.

## Chapter 2

## REVIEW OF THE LITERATURE

Because most, if not all, research is an outgrowth of previous study, a review of the literature pertinent to the concerns of this experiment was required in order to provide a basis for the experiment, the results, and possible implications. The study involved mental imagery and the use of pictorial or verbal presentations. The review of the literature is divided accordingly.

### Uses of Imagery

Mentally processing information involves more than one method, such as verbal language. The processing uses many symbolic representations, including imagery (NSSE, 1974, p. 58). The uses of imagery vary, including productive imagery - constructing unseen images by combining recognized images; manipulative imagery - mentally changing images; and supplementary imagery - aiding in understanding the written word (Bower, 1972, pp. 56-57).

The ability of a person to image has been considered since the time of the ancient Greeks. Elaborate schemes for organization, association, and retrieval of information were formulated, based on the use of mental images to facilitate recall (Paivio, 1971, pp. 153-176). Although the ancient memory schemes relying on mental imagery were taught only to scholars, more recent research has indicated that almost all human beings possess the ability to image (Betts, 1909; McKellar, 1965; Sheehan, 1967a).

Studies have been conducted to determine the ability of persons to mentally generate pictures based on the written word. The studies included introspective interviews (Betts, 1909), which had been the means of determining the presence of imagery ability prior to 1909. Persons who had lower imaging ability had difficulty articulating that which they were trying to image (Betts, 1909).

The development of a written instrument (Betts, 1909), using 125 psychology students and 14 psychologists as subjects, provided a means of numerically rating one's imagery and determining one's overall imagery ability. The test is known as the Betts' Questionnaire Upon Mental Imagery (QMI) (Betts, 1909). This test was later revised into a shortened form (Sheehan, 1967a) which achieved the same purpose. These studies indicated that people have varying capabilities in projecting mental images - the images range from very clear and precise to very vague and hazy, as indicated by the range of scores on these tests. (Betts, 1909; Sheehan, 1967a). Imagery ability and academic aptitude vary, but there is little or no correlation between the variances (Betts, 1909; Davis, 1932; Stewart, 1965). The range of correlations was -.17 to .289.

Imagery has proved to be highly effective as a general memory code (Paivio, 1971, pp.327-352). Specifically, the ability to image can be used to facilitate recall of a correct response when a person is presented with a stimulus (Bower, 1970; Rimm, 1969). Bower (1970) found indications of this in an experiment conducted to determine the effects of different types of learning instructions. Thirty high

school graudates were instructed to learn the information, 30 paired-associates, presented by one of three methods: Spoken rote repetition, interactive imagery and non-interactive imagery. The results indicated that there was a significantly better recall, $p < .001$, by the students who had been instructed to use interactive imagery as the learning style.

In an experiment involving 80 introductory psychology students, Rimm and others (1969) also tested the influence of varying instructions on learning paired-associates. The three types of instructions were rote rehearsal, verbal meditation (making up a phrase or sentence containing the two words), or imagery projection. Results indicated that the use of mental imagery promoted significantly better recall, $p < .001$.

In experiments conducted to compare the use of imagery and the use of verbalization to learn material, more learning (higher recall) occurred among the imagers than among the verbalizers (Bower, 1967; Bugelski, 1970; Bugelski, Kidd and Segmen, 1968). In the Bugelski, Kidd and Segmen study (1968), the experiment involved the recall of a list of words originally learned through a rhyming memory system with imagery instructions, or a rhyming memory system only or without any system for learning the words. The results of the tests of the 90 students indicated that the inclusion of imagery with the memory system significantly increased recall ($p < .05$). This study also tested varying rates of presentation at 2, 4 and 8 seconds. The significant differences in recall occurred in those presentations at

the 8 second rate. The authors concluded that it took the students 4-8 seconds to form a useful image, i.e., one that promoted recall. In another study involving 24 paired-associates (Bugelski, 1970), twenty students were instructed to try to remember the correct responses either by forming sentences using the two words or by imaging. The means for the sentence forming group and the imaging group were 10.20 and 17.15 correct responses respectively.

Another study, involving the use of paired-associations, included instruction for one of the groups to invent sentences using the two words, to assist in subsequent recall. The second group read sentences which had previously been prepared using the two words. Recall was higher for the subjects who constructed their own sentences. Persons who reported imaging during the experiment had even greater recall (Bower, 1972).

Thinking in "pictures" may be a person's cognitive style. It may be repressed in favor of word representations, but imagery can prove to be useful for recall in some instances (Horowitz, 1967). The study involved 112 adults listing examples of the types of imagery they had and how they used it, such as remembering information and daydreaming. As indicated by Paivio, Smythe and Yuille (1968, p. 440), "where they can be used, images are 'preferred', but verbal mediations can also function effectively and presumably must always be involved to some extent where the overt learned response is verbal."

Sheehan (1967c) hypothesized that vivid imagers perceived

information literally, while poor imagers encode the information verbally in order to retain it. The complexity of the information would influence the poor imagers ability to encode the information of mental storage and decode it for recall. The experiment involved pictorial displays of arrays of geometric figures shown to 72 psychology students, rated as vivid or poor imagers using the shortened Betts' QMI (Sheehan, 1967a). As the arrays became more complex, poor imagers were less accurate in reproducing the stimuli than vivid imagers. The difference was significant at $p < .01$. In the experiment the stimuli became increasingly more complex and finally reached the point that both High and Low Imagers had inaccurate recall.

Complexity of the stimuli is not the only variable which may affect how easily the stimuli is imaged and recalled. Concreteness or abstractness of the material to be learned has an effect on the ease with which mental imagers can be evoked. Concrete material was more easily imaged than abstract (DiVesta and others, 1971; Paivio, Yuille and Madigan, 1968). In an experiment requiring free recall of concrete or abstract information presented, the results of the tests of 219 introductory educational psychology students indicated a significant correlation ($p < .001$) between concreteness of the information and recall (DiVesta and others, 1971). However, those who reported using vivid imagery had significantly lower, $p < .05$, scores on the recall of abstract material. The authors (DiVesta and others, 1971) suggested that these results may have been caused by

the difficulty incurred in trying to image abstract material, a difficulty incurred by all levels of imagers.

In determining levels of concreteness of abstractness of words, Paivio, Yuille and Madigan (1968) found a correlation of .83 between the rating for concreteness and the imagery rating. In addition, specific nouns, such as table, evoked images more readily than general nouns, such as furniture (Paivio and Olver, 1964). The 80 subjects involved in this experiment using paired-associates recalled significantly more specific nouns ($p < .001$) than general nouns.

In studies to determine the effects of imagery instructions (i.e., to mentally picture the information presented) subjects who were instructed to image had better recall than others (Elliott, 1973; Eoff and Rohwer, 1972). In the Elliott (1973) study, imagers recalled significantly more ($p < .05$) than did the students who learned by repetition, and delayed recall was lower for the groups, but the imagers forgot less. The Eoff and Rohwer (1972) study compared 240 students who had received specific instructions to image and those who had not. Imagers recalled at a significantly higher level ($p < .002$). Neither study included grouping students according to imagery level. However, in both studies some subjects, as part of the various treatments employed, were actively imaging in order to promote better recall.

Assimilation of information is most effective when the student is actively involved in the process of learning (NSSE, 1974, p. 77). Imaging provides such an involvement. Instructions to image

facilitated paired-associate learning (Rimm and others, 1969), particularly when the instructions indicated the subjects were to mentally picture interacting imagers (e.g., given the words DOG-BICYCLE, the subject might image a dog riding a bicycle) (Bower, 1970; Epstein, Rock and Zuckerman, 1960). The Epstein, Rock and Zuckerman (1960) experiment compared the responses of 40 students to interactive and noninteractive cartoon drawings. The interactive cartoons promoted better recall ($p < .01$).

Imaging may occur when information is received (the person creates a mental picture), and when information is being recalled (the person recalls an image), or both. This information was presented in a variety of forms, pictorial or written, but the encoding of the information was preferably pictorial for High Imagers (DiVesta and others, 1971). The authors suggested that these High Imagers would profit more from instruction which included graphic displays. Persons reporting vivid imagery had more accurate recall ($p < .01$) of pictorial information than those reporting poor visual imagery (Marks, 1974).

Studies have been conducted on the use of visual presentations or visual imagery to promote the retention and recall of information. Indications were that the use of visual presentations increased retention spans and recall capabilities (DiVesta and others, 1971; NSSE, 1974, p. 247; Paivio, 1968).

Use of Pictorial and/or Verbal Presentations

Debes and Williams (1974) suggested that about 30% of students learn more efficiently visually (through the use of pictures) than verbally (through the use of written material). Also indicated were a variety of uses for pictures, such as communicating about a process, providing a convincing argument, saying something new, creating an emotional reaction and expressing personal concern (Debes and Williams, 1974). One of the purposes of using visuals in today's education is to promote recall of information.

Although some studies consisting of comparisons of methods such as film vs. print vs. live teachers have resulted generally in no significant differences in outcomes, and some authors consider the impact of technology on children's learning as neglibible (NSSE, 1974, pp. 6-7), the conclusions of other studies were that a combination of verbal and pictorial representations facilitates memory (NSSE, 1974, p. 247).

In a study (Paivio, Rogers and Smythe, 1968) including 80 introductory psychology students as subjects, slides of familiar objects of their names were shown. Free recall of the information was the test. The results of the test indicated that the pictures were recalled more often ($p < .01$) than the words. After several presentations the experimenters determined that the pictures were remembered better from presentation to presentation. There seemed to be less interference in the recall of pictures with pictures remembered from previous presentations. The authors suggested that

pictures were retained better in long term memory and that possibly the information contained in the pictures was stored pictorially and verbally. Recall was facilitated because a response concerning the information could be retrieved from either verbal or image storage or both (Paivio, Rogers and Smythe, 1968).

To examine the possibility of two separate memory systems, Levie and Levie (1974) conducted an experiment using pictorial and verbal presentations with verbal interference during the presentations. Results of the recall tests indicated that the verbal interference lowered recall of the material included in the verbal presentation. Recall of the pictorial information was significantly higher ($p < .01$). Levie and Levie (1974) concluded the presence of two separate memory systems, one pictorial and one verbal, and suggested that the systems are often interconnected, but can operate separately (Levie and Levie, 1974). Students have a tendency to recall information in the form in which it was presented (DiVesta and others, 1971).

Pictures can have a multiplicity of interpretations (Porcher, 1972; Wendt, 1956). Spaulding (1955) suggested that the content of an illustration should relate to the reader's life and interest if it is to be effective, because pictures are viewed in light of past experiences. Hartman (1961) suggested that pictures provided more cues which facilitate recall. In an experiment involving 84 undergraduate psychology students learning 20 paired-associates, Paivio and Yarmey (1966) discovered that those items presented as pictures were recalled significantly more often ($p < .001$) than those items

presented as words. They also suggested the facilitating effect of picture cues. However, in an experiment conducted to determine how illustrations in a persuasive speech affected attitude change, speaker credibility and information recall, results indicated significant differences ($p < .05$) in the first two items but little effect on the retention of content (Seller, 1971).

Hartman (1961) suggested that pictorial illustration facilitated learning, provided the picture related to the material presented. In an experiment designed to test the use of presentations of related and unrelated material, Severin (1967) found that a pictorial presentation with a related audio presentation significantly affected recall ($p < .01$) when compared with a presentation of pictures with unrelated audio. A combination of language and image prompts memory (NSSE, 1974, p. 247), in that the use of print to label a picture focuses subjects' attention and reduces incorrect interpretation of the picture (Hartman, 1961).

Pictures can be in the form of visuals presented or images aroused. Experiments conducted concerning the ability of words to arouse images indicated that the concreteness of the term correlated highly, .83, with that of the vividness of imagery aroused (Paivio, Yuille and Madigan, 1968). Pictorial representations of abstract words make the words more concrete and provide an image for the subject who cannot generate one (NSSE, 1974, p. 401). A study conducted with 120 university students (Paivio, 1963), using adjective-noun/noun-adjective paired-associated, indicated that

concrete nouns were recalled more often ($p < .001$). The results of Paivio's 1968 experiment indicated that possibly pictures were more effectively retained and retrieved from long term memory.

In an experiment (Dwyer, 1969) to determine the usefulness of various types of visuals in presenting information, slides of photographs, shaded line drawings of photographs, outlines of photographs, and abstract line cartoons were used to present information to 267 high school students. The abstract line cartoons significantly ($p < .01$) increased recall of the information presented. Ryan and Schwartz (1956) determined that cartoon drawings specifying spatial relationships were the fastest to be perceived. Their experiment concerned the presentation of photographs, shaded drawings, out-lines and cartoon drawings, presented at varying rates of speed. The speed of perception was significantly faster ($p < .001$) for the cartoon drawings.

Cartoon drawings indicating the items named in the paired-associate as a unit (such as a CAT on a SHIP as opposed to a CAT and a SHIP) promoted higher recall (Epstein, Rock and Zuckerman, 1960). Dwyer (1969) suggested that the excessive stimulation of photographs, shaded drawings or outlines of a photograph may have proved to be confusing to the learner. Additional cues from pictures increase learning only so long as they do not create an overload of cues, which results in interference and hence lowers learning (Hartman, 1961).

In considering the various types of materials to be used in

presentations, Dwyer (1968) concluded that the most effective use of visuals was decided by the type of objective to be reached. Her experiment was to consider objectives measuring identification and terminology. An oral presentation together with printed materials was as effective as these presentations plus visual illustrations. However, on a drawing test, students viewing the illustrated presentation scored significantly higher ($p < .01$) (Dwyer, 1968).

Related Literature

There are indications that students may have difficulty in retaining information available simultaneously in several different forms. Too many cues from visuals included with the instruction causes an overload and consequently interferes with learning (Hartmen, 1961). Severin (1967) indicated that multiple channel communication (audio-print and audio-pictorial) was superior to single channel communication (audio or print or pictorial) when related information was presented. However, when unrelated information was simultaneously presented, confusion in recall resulted. Recall of the unrelated presentation was significantly lower ($p < .01$).

In an experiment testing the use of pictorial, auditory and a combination of both in presentations, the visual presentation led to significantly higher recall scores ($p < .001$) than the auditory presentations (McCall and Rae, 1974). The combination presentation scores did not exceed either visual scores or auditory scores. The authors suggested that the auditory scores may have been lowered because of the written testing procedure. This suggestion is

compatible with the Hartman (1961) conjecture that cues from pictorial presentations facilitate recall when those cues are present during the testing situation.

Although active student involvement is effective in a learning situation (NSSE, 1974, p. 77), Travers (1968) indicated that confusion resulted from students trying to participate while a demonstration was being shown. The author felt this was an indication of an overloaded condition, too much information trying to be processed by the students at one time. Consequently, the students mentally "turned off" at least one channel and thereby did not learn some of the material on which they were tested.

Summary

Imagery has a variety of uses as a symbolic representation, including productive, manipulative and supplementary imagery (NSSE, 1974; Bower, 1972). Mental imaging has been used as a memory device since the time of the ancient Greeks (Paivio, 1971). More recent studies have indicated that all persons have the ability to image at some level, (i.e., vivid or vague) (Betts, 1909; McKellar, 1965; Sheehan, 1967a) and that there is a lack of correlation between this ability to mentally image and general academic aptitude (Betts, 1909; Davis, 1932; Stewart, 1965).

The ability to image was measured by extensive introspective interviews prior to 1909 when a reliable written test was designed (Betts, 1909). This written instrument was later shortened to provide a reliable measure of a person's imagery ability

(Sheehan, 1967ab).

Generally, imagery has proved to be useful in prompting memory for correct responses (Bower, 1967, 1970, 1972; Bugelski, 1970; Bugelski, Kidd and Segmen, 1968; DiVesta and others, 1971; Elliott, 1973; Eoff and Rohwer, 1972; Horowitz, 1967; Marks, 1974; NSSE, 1974; Paivio, 1971; Paivio and Olver, 1964; Rimm and others, 1969; Sheehan, 1967c), particularly when subjects have been instructed to mentally picture objects interacting (Bower, 1970; Epstein, Rock and Zuckerman, 1960).

Experiments indicated that vivid imagers store information pictorially (DiVesta and others, 1971; Sheehan, 1967c). The complexity, concreteness/abstractness, and specificity of information affected how easily information could be mentally imaged and subsequently recalled (DiVesta and others, 1971; Paivio and Olver, 1964; Paivio, Yuille and Madigan, 1968; Sheehan, 1967c).

Pictures have uses similar to those of imagery in that one of the uses of pictures is to promote recall (Debes and Williams, 1974; NSSE, 1974; Paivio, Rogers and Smythe, 1968).

Studies comparing the use of pictorial and verbal presentations of information indicated that pictures were superior (Dwyer, 1968; Levie and Levie, 1974; NSSE, 1974; Paivio, Rogers and Smythe, 1968; Paivio and Yarmey, 1966). Results of some experiments suggested the possibility of two memory systems, pictorial and verbal, that were separate but closely related (DiVesta and others, 1971; Levie and Levie, 1974).

Hartman (1961), Porcher (1972), Spaulding (1955), and Wendt (1956) indicated that pictures were interpreted according to the person's past experience and that pictures provided more cues to prompt memory. However, Dwyer (1968) suggested that the usefulness of visuals might be indicated by the type of information to be presented and remembered. The use of combined presentations such as audio-visual programs or illustrated texts may (Severin, 1967) or may not (Dwyer, 1968) increase learning.

Presentations which combined several formats, such as pictorial-verbal, audio-visual, audio-verbal, did not necessarily increase learning (Hartman, 1961; McCall and Rae, 1974; Severin, 1967; Travers, 1968). The decreased learning may have been caused by an overloading of the subjects' learning systems from too many cues simultaneously (Dwyer, 1969; Hartman, 1961; Travers, 1968).

The review of the literature indicated that the use of visuals, either mentally imaged or pictorially presented, assisted in the retention and recall of concrete and abstract information. This was particularly evident when the visuals were not too complex, i.e., causing interference with learning, and when associations were concluded.

That the ability to image mentally varies among people and this ability may affect the way a person processes information for subsequent recall were also indicated. The processing of information may be affected by the means of presentation, either pictorial or verbal, of the material to be learned.

An extensive review of Current Index to Journals in Education, Dissertation Abstracts, Education Index, Psychological Abstracts, Readers' Guide to Periodical Literature, and Resources (Research) in Education indicated that there had not been a study conducted to determine if community college students' varying ability to image interacted with the type of presentation, pictorial or verbal, to promote learning concrete and abstract material. If a reaction promoting better recall and increased retention of material occurred, more consideration would need to be given to imaging as a learning skill. It could provide an alternative approach to the learning of material.

## Chapter 3

## RESEARCH METHODOLOGY

### Introduction

The purpose of the study was to consider the effects of mental imaging on community college students' ability to recall paired-associates presented in pictorial format.

### Population and Sample

The population represented in this study was the student body of a rural community college of approximately 1300 students, both full- and part-time. Subjects included unclassified students as well as those enrolled in occupational-technical and college transfer programs.

The 103 subjects who participated in the experiment were students in Introductory Psychology or Human Relations classes. Introductory Psychology was a course sequence of three quarters, required by all Education majors and used as a general psychology course requirement for other programs. Human Relations was a required course in the occupational-technical curricula. This sample was comprised of 36 occupational-technical students, 63 college transfer students and 4 unclassified students.

Instruction in these students' classes was tailored to meet the learning requirements of the students, such as individual counseling, tutoring when required and remedial reading courses. Self-instructional materials for many classes were available through a Learning

Laboratory. A variety of audio-visual presentations, including films, slides, slide-tape programs and overhead projections, were used in many classes to present basic and supplemental material. Some of the students' other classes were presented almost entirely in an audio-visual format, such as a slide-tape presentation. Therefore, the students had been exposed to the use of visual presentations of material to be learned. The use of slides to present information, as in this research situation, was not an unusual occurrence for these students.

The verbal aptitude of these students, as measured by the verbal score on the School and College Ability Test (SCAT), ranged from the first percentile to the ninety-ninth with a mean of 50.6.

Test to Measure Imagery Ability

Determination of a person's ability to image was ascertained, prior to 1909, by extensive introspective interviews with subjects concerning how they "pictured" a stimulus. Only persons trained in introspection could reliably supply responses to questions concerning how they imaged. Other subjects encountered great difficulty in trying to verbalize their images (Betts, 1909, pp. 5-9).

Betts conducted a series of studies to formulate a written instrument which would permit, without extensive introspective interviews, testing the ability of a person to image. The instrument consisting of 150 items, was tested on three groups of college students and was compared with the results of both testing and interviewing of psychologists. The results indicated that the

instrument was reliable in indicating the ability of a person to image (Betts, 1909). Subsequent research using this instrument indicated almost no correlation between the ability to image and general scholastic ability (Betts, 1909; Davis, 1932; Stewart, 1965).

Further study of the Betts' instrument, known as the Betts' Questionnaire upon Mental Imagery (QMI) (Sheehan, 1967a), using 140 male and 140 female Australian University students, indicated that certain items presented in the questionnaire accounted for most of the variation in the scores. These 35 items were used to construct a shortened form of the Betts' QMI. Analysis of the short test indicated that it measured a general ability to image and that it would reliably differentiate among individuals in their ability to image. Cross validation of this short test, using an independent sample, indicated a .99 correlation between the long and short forms of the test (Sheehan, 1967b).

A study to determine if this test was a reliable measure of American college students' ability to image was conducted using 62 American college students (Sheehan, 1967b). The short form of the test was administered on two occasions separated by 7 months. The test-retest reliability was .78. Using a group of 35 adult students as subjects, Evans and Kamemoto (1973) found the test-retest reliability over a period of 6 weeks was .91. Juhasz (1972) tested the internal reliability of the shortened Betts' QMI using 67 undergraduates and 12 professors. The estimates of reliability (odd-even) were .95 for the undergraduates and .99 for the professors.

This shortened test, consisting of 35 items, was used to differentiate high imagers (those able to mentally project very vivid images) and low imagers (those able to project only vague images). The author of the test, Peter W. Sheehan, granted permission to duplicate and use the instrument in this study. A copy of the test is included in Appendix A.

Preparation of the Presentations

Paired-associate nouns were used as the material to be learned for this experiment, because paired-associate learning is the most elementary associate learning task. The use of nouns is an experimental convenience that keeps educational experiments in contact with the verbal learning mainstream (Bower, 1972).

The nouns were chosen from a list of 925 nouns which had been rated according to the level of concreteness in an experiment conducted by Paivio, Yuille and Madigan (1968). In the experiment, over 500 students rated the nouns on a 1 to 7 scale, abstract to concrete. The mean of all the ratings for each word was the abstract/concrete level indicated in the Paivio, Yuille and Madigan (1968) list.

The nouns used in this experiment were chosen on the basis of their concreteness/abstractness and frequency of use as rated by Thorndike and Lorge (1944). The frequency rating was used as a determinant in order to eliminate those nouns which may have been rated as concrete or abstract, but might be unfamiliar to the sample. An example is a word such as thicket which had a relatively high

concreteness rating, 6.49, but had a lower frequency rating than the words chosen for this experiment.

Twenty-eight concrete words and 28 abstract words were chosen for the study. On a scale of 1-7, the ratings for the concrete words ranged from 6.90 to 7.00, with a mean of 6.95. The ratings for the abstract words ranged from 1.42 to 2.97, with a mean of 2.19. Fifty-one of the total 56 words had a frequency rating of A or AA, the highest frequency ratings in the Thorndike and Lorge (1944) list. The remaining words had ratings which indicated a high frequency or were felt by the investigator to be familiar to the students. In a pilot study conducted with 15 students not participating in the experiment, the students indicated that all the words were familiar to them.

In order to determine the effects of imagery ability and presentation method on learning different types of material, four categories of paired-associates were used in the experiment. These categories were concrete stimulus-concrete response (CC); concrete stimulus-abstract response (CA); abstract stimulus-concrete response (AC); and abstract stimulus-abstract response (AA).

The pairs of words for the experiment were chosen randomly within each category, with obviously associated pairs, such as SPIRIT-HEAVEN, being replaced and another pair drawn from the concrete or abstract terms remaining.

Twenty-eight pairs were chosen; cartoon drawings depicting the interaction of the two words were completed by the investigator. For

example, for the combination BUTTER-BIRD, the drawing indicated a bird standing on a stick of butter. These cartoon drawings, complete with their verbal labels (the paired-associate), were shown to the 15 students participating in the pilot study. The students indicated that they had no difficulty in recognizing the items depicted, or in relating them to the verbal labels, particularly in the case of the abstract terms such as MIND, where a brain was pictured.

After the cartoons and labels were copied on to white bond paper, using black ink and a primary typewriter, the pictures were photographed and made into 35 mm slides. These slides were used in the pictorial presentation. Copies of the original drawings and labels are included in Appendix B.

The slides for the verbal presentation were produced by using a primary typewriter to type the words of the paired-associates on a sheet of white bond paper. These sheets were then photographed and made into 35 mm slides.

The directions for the experiment were recorded on cassettes, one for the pictorial presentation and one for the verbal presentation. The directions indicated what the experiment was about; how the presentation would occur (examples were included); a description of the test which would follow the presentation (example given); and a request for questions. The pictorial presentation directions indicated that the students would see interactive cartoon drawings and labels and that the students should mentally picture these drawings to facilitate recall during the test. The verbal presentation

directions indicated the students would be given only the paired-associates, and they were to image mentally an interacting picture to facilitate subsequent recall. The scripts of directions for each treatment and drawings of the slides used as examples are included in Appendix C.

The remaining tape in the cassette was electronically pulsed to automatically project each of the 28 slides in the actual presentation for 7 seconds each. Previous research indicated that students required from 4 - 8 seconds to form a useful mental image (Bugelski, 1968). The study also indicated that when students were permitted to control the rate of presentation, the average rate was 7 seconds.

The order of slides in the presentation was random. The drawings in Appendix B are arranged in the order of the presentation. The order of the pictorial presentation was chosen, and then the verbal slides were arranged in the same order. After all slides were placed in projection trays, a black slide was included to signal the conclusion of each presentation.

The experiment was conducted using a Kodak Carousel slide projector synchronized with a Wollensak 2560 cassette playback unit.

## Procedure of the Experiment

Three weeks prior to the experiment, the students were tested using the shortened Betts' QMI. Directions for completing the form were written on the front of the test.

The test required participants to rank the vividness of their

mental images of 35 separate items listed. The scale for ranking was 1 to 7, perfectly clear and vivid to no image at all - the lower the score, the higher the imagery. An example of an item on the test was one which asked the student to consider an image which came to his mind's eye of a red apple. If his visual image was moderately clear and vivid, he checked the rating scale and marked "3" on the prepared answer sheet. Total score was the combination of all of these rankings. The lowest total score possible was 35 - if a subject indicated a perfectly clear and vivid mental image for each test item. The highest score possible was 245 - if a subject indicated no image at all for all of 35 items. Based on their total scores on the test, the students were divided into two groups, one group labeled High Imagers (HI) and the other group labeled Low Imagers (LI). In order to have approximately equal-sized groups in the two levels of imagers, those students having imagery scores of 130 and above were considered to be Low Imagers. Those having scores of 129 or lower were considered to be High Imagers. The scores of the High Imagers ranged from 45-129; the scores of the Low Imagers ranged from 130-244. The score ranges by curriculum were 65-234 for occupational-technical students ($\overline{X}$=128.06), 45-244 for college transfer students ($\overline{X}$=135.48), and 110 to 204 ($\overline{X}$=149.00) for unclassified students. A complete listing of the imagery scores is included in Appendix D.

To control for intelligence, the students within each imagery group (High or Low) were ranked according to their verbal aptitude

score. These scores were obtained from the School and College Ability Test (SCAT). The scores were an indication of the students academic ability and were included in each student's permanent file at the college. Permission to obtain these scores from the files was obtained from each student participating in the study. Some students who participated in the study were not included as final subjects because of the lack of an aptitude score.

The two subjects with the highest verbal aptitude scores among the High Imagers, who were identified by the Betts' QMI, were randomly assigned, one to each treatment group. The next two highest scores, within the High Imagers, were randomly assigned, one to each treatment group. This procedure was continued until all the High Imagers had been assigned to one of the two treatment groups. The process was then repeated for the Low Imagers. This procedure provided a similar range of verbal aptitudes in each treatment group. The SCAT scores for each subject are included in Appendix D.

After the students had been divided (according to imagery ability and verbal aptitude) into two groups, the treatments were randomly assigned, one to each group, pictorial or verbal.

## Conducting the Experiment

The actual experiment was conducted during the period the students normally attended Introductory Psychology or Human Relations class. All students who attended class the day of the experiment participated. However, only those students for whom SCAT scores were available and who completed the shortened Betts' QMI were

included as subjects in the experiment.

The investigator divided the class according to treatment group. (The assignments had been completed on paper and marked on copies of the class roster.) Those students who were to see the second presentation were dismissed from the classroom for 20 minutes. The decision on which presentation, either pictorial or verbal, was to be shown first was randomly decided by flipping a coin prior to the beginning of each class.

After the first presentation was shown, the students completed the test on the presentation. The recall test was a listing of the 28 stimulus nouns (those which appeared first in the pair) in random order. The students were directed to write the correct response (the one shown in the presentation) beside each word. A copy of the recall test is included in Appendix E. Upon completion, the students were then dismissed, and the other part of the class returned to view their presentation and be tested. This procedure was followed for each class until all the subjects had viewed either the pictorial presentation or the verbal presentation and been tested for immediate recall.

Two weeks after the original presentations and testing, the investigator returned to each class to administer the previously unannounced re-test on the paired-associates. The students had been informed that there would be another part (other than the shortened Betts' QMI and the paired-associate presentation) to the experiment. However, they were not informed of the delayed post-test in order to

eliminate, as much as possible, any attempts to prepare for the test.

The re-test items were in random order and differed from the order of the presentation and the original test. This was done to minimize the possible effects of order (of the presentation and the immediate recall test) in promoting recall on the delayed test. A copy of the delayed test is included in Appendix F.

Both sets of tests, immediate and delayed, were hand-scored by the investigator. The scores were recorded according to the number of correct responses in each category of paired-associates, concrete-concrete (CC), concrete-abstract (CA), abstract-concrete (AC), and abstract-abstract (AA). These eight scores were then entered on each student's data card for analysis. The scores are given for each recall test in Appendix D.

## Analysis of Data

A combination of tests was used to analyze the data. A Multivariate Analysis of Covariance was used to analyze the results of the immediate recall test, which consisted of the scores for the correct responses in each of the four categories of paired-associates. The factorial design for this portion of the study was 2 x 2 and could be visualized as shown in Figure 1.

A Univariate Analysis of Covariance with repeated measures was completed on each pair of scores, immediate and delayed, for each category of paired-associates (CC, CA, AC, and AA). The factorial design for this portion of the study was 2 x 2 x 2 and could be

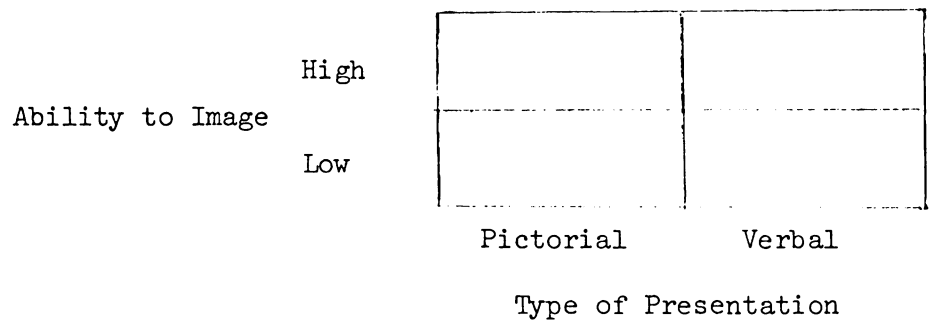



Figure 1. Illustration of the 2 x 2 Factorial Design for the Multivariate ANCOVA

visualized as shown in Figure 2.

In all of these tests, the SCAT score was covaried to control for the effect of intelligence on the ability to learn and to more clearly indicate the effects and interactions of the independent variables of imagery ability, presentation method and time.

The imagery ability scores and the SCAT verbal aptitude scores were analyzed using a Pearson *r* to determine the correlation between the two abilities.

## Hypotheses

Using the Betts' QMI score as an indication of imagery ability and the verbal SCAT score as an indication of academic aptitude, the following hypotheses were tested:

*Hypotheses 1*. There is no difference in the ability to recall paired-associates from short-term memory due to (a) imagery ability, (b) type of presentation or (c) the interaction of imagery ability and type of presentation.

*Hypotheses 2*. There is no difference in the ability to recall *concrete-concrete* paired-associates due to (a) imagery ability, (b) type of presentation, (c) time of testing, (d) interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) interaction of time of testing and type of presentation.

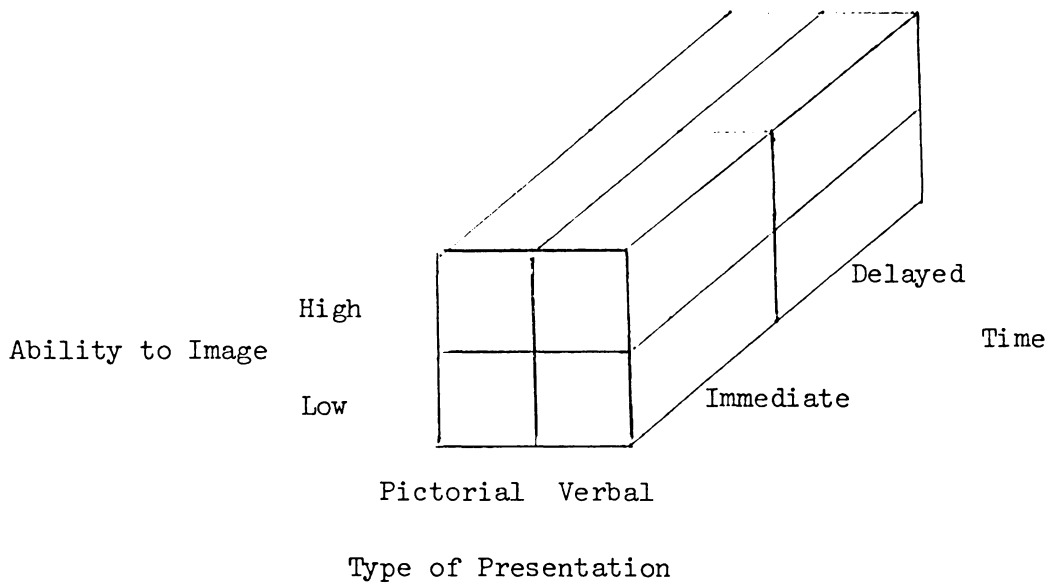



Figure 2. Illustration of the 2 x 2 x 2 Factorial Design for the Univariate ANCOVA with Repeated Measures

Hypotheses 3. There is no difference in the ability to recall concrete-abstract paired-associates due to (a) imagery ability, (b) type of presentation, (c) time of testing, (d) interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) interaction of time of testing and type of presentation.

Hypotheses 4. There is no difference in the ability to recall abstract-concrete paired-associates due to (a) imagery ability, (b) type of presentation, (c) time of testing, (d) interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) interaction of time of testing and type of presentation.

Hypotheses 5. There is no difference in the ability to recall abstract-abstract paired-associates due to (a) imagery ability, (b) type of presentation, (c) time of testing, (d) interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) interaction of time of testing and type of presentation.

The hypotheses above were tested for significance at the .05 level.

Hypothesis 6. There is no correlation between imagery ability and academic aptitude.

## Chapter 4

## ANALYSIS OF THE DATA

The study considered the effect of the ability to image mentally on learning. The variables in the study were imagery ability level, high or low, and the type of presentation, pictorial or verbal. The effect of these variables on learning was measured by means of the 28 - item recall test, administered on two separate occasions, concerning the information originally presented. The information presented consisted of four categories of paired-associates: concrete-concrete, concrete-abstract, abstract-concrete, and abstract-abstract.

The results of the immediate recall test were analyzed using a Multivariate Analysis of Covariance. The range of these scores was 2 to 25. See Appendix D for individual scores. This was used to determine the effect of imagery ability, type of presentation and interaction between them on recall across all four categories of paired-associates.

The results of the immediate and delayed testing of each category of paired-associates were analyzed using a Univariate Analysis of Covariance with repeated measures. The range of the delayed scores was 0 to 14. See Appendix D for individual scores. This was used to determine the effect of imagery ability, type of presentation, time and interaction between them on the recall of each category of paired-associates.

The use of covariance in both of these tests statistically controlled for SCAT. The effects of intelligence (as indicated by the SCAT scores) were held constant. Analysis of Covariance (ANCOVA) assumes no covariate-treatment interaction. This assumption was tested statistically in the ANCOVA; no interaction was found.

The imagery scores and SCAT verbal scores were analyzed using a Pearson *r* to determine if there was a correlation between imagery ability and verbal aptitude.

The hypotheses tested and the analyses results are included in this chapter.

## Analysis of the Null Hypotheses

Hypotheses 1. There is no difference in the ability to recall paired-associates due to (a) imagery ability, (b) type of presentation or (c) the interaction of imagery ability and type of presentation.

As indicated in the summary table of the results of the analysis (Table 1), no significant difference in recall was evident. The F ratios were .952, 2.414 and 1.115 for imagery ability, type of presentation and interaction, respectively. None of these F values were significant at the .05 level, as $p$ = .438, .054 and .354. Therefore, Hypotheses 1a, 1b and 1c were not rejected.

A comparison of mean scores by treatment indicated differences between means of each type of presentation (pictorial or verbal) ranging from .092 for abstract-abstract pairs to .815 for abstract-concrete pairs. Those subjects who viewed the pictorial presentation

Table 1

Summary Table of Multivariate Analysis of Covariance on Immediate Testing

| Source | $df_{Hyp}$ | $df_{Error}$ | F | p[a] |
|---|---|---|---|---|
| Imagery | 4.000 | 95.000 | .952 | .438 |
| Treatment (Type of Presentation) | 4.000 | 95.000 | 2.414 | .054 |
| Imagery X Treatment | 4.000 | 95.000 | 1.115 | .354 |

[a]F = 2.465 at .05 level.

scored higher in all categories of paired-associates. The means for each category are indicated in Table 2.

The range of the difference between mean scores by imagery level, high or low, was .069 for abstract-concrete pairs to .427 for abstract-abstract pairs. Low Imagers scored consistently higher in the recall of responses in all four categories of paired-associates. The means for each category are indicated in Table 3.

Hypotheses 2. There is no difference in the ability to recall concrete-concrete paired-associates due to (a) imagery ability, (b) type of presentation, (c) time of testing, (d) the interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) time of testing and type of presentation.

There was no significant difference in the ability to recall the information due to imagery ability, the type of presentation, the interaction of imagery ability and time of testing or the interaction of time of testing and type of presentation as indicated in Table 4. Therefore, Hypotheses 2a, 2b, 2e, and 2f were not rejected.

However, there was a significant difference ($F = 4.080$; df 1. 96; $\alpha < .05$) due to the interaction of imagery ability and type of presentation (treatment). Therefore, Hypothesis 2d was rejected. Figure 3 illustrates this interaction.

From the pictorial presentation, the High Imagers recalled more

Table 2

Mean Scores of Paired-Associate Categories by Treatment (Type of Presentation) Adjusted for Covariance of SCAT Scores

| | CC | CA | AC | AA |
|---|---|---|---|---|
| Pictorial Presentation | 5.759 | 4.343 | 3.403 | 2.847 |
| Verbal Presentation | 5.342 | 3.749 | 2.588 | 2.755 |

Table 3

Mean Scores of Paired-Associate Categories by Imagery Level
Adjusted for Covariance of SCAT Scores

| | CC | CA | AC | AA |
|---|---|---|---|---|
| High Imagers | 5.387 | 4.035 | 3.003 | 2.586 |
| Low Imagers | 5.748 | 4.118 | 3.072 | 3.013 |

Table 4

Summary Table of Analysis of Covariance for Scores on Concrete-Concrete Paired-Associates Tests

| Source | Sum of Squares (Adj. for SCAT) | df | Mean Square | F | p[a] |
|---|---|---|---|---|---|
| Imagery | 2.770 | 1 | 2.770 | .930 | ns |
| Treatment (Type of Presentation) | .049 | 1 | .049 | .016 | ns |
| Imagery X Treatment | 12.147 | 1 | 12.147 | 4.080 | * |
| Error (Between) | 285.757 | 96 | 2.977 | | |
| Time | 880.548 | 1 | 880.548 | 646.511 | ** |
| Imagery X Time | 1.478 | 1 | 1.478 | 1.086 | ns |
| Treatment X Time | 5.313 | 1 | 5.313 | 3.901 | ns |
| Error (Within) | 130.764 | 96 | 1.362 | | |

[a]F = 3.945 at .05 level
F = 6.915 at .01 level

*p < .05
**p < .01

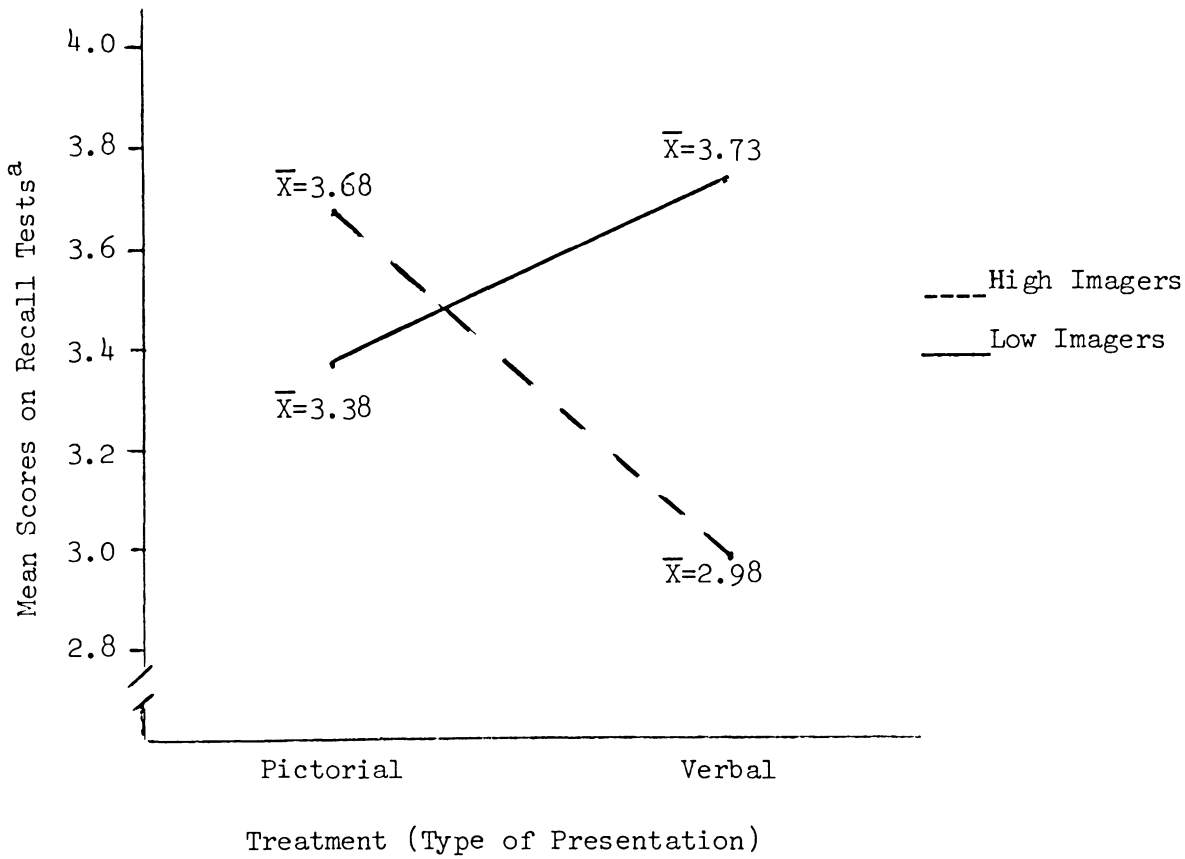



Figure 3. Effect of Interaction of Imagery Ability and Treatment on a recall of concrete-concrete paired-associates.

[a]Combination of immediate and delayed tests

($\overline{X}$ = 3.68) than did the Low Imagers ($\overline{X}$ = 3.38). Low Imagers recalled more ($\overline{X}$ = 3.73) than High Imagers ($\overline{X}$ = 2.98) from the verbal presentation.

Also indicated in Table 4 is the significant difference ($F = 646.511$; df 1, 96; $\alpha < .01$) in the recall of concrete-concrete paired-associates due to time (immediate and delayed testing). Therefore, Hypothesis 2c was rejected. The mean score for the immediate test was 5.57, for the delayed test 1.34.

Hypotheses 3. There is no difference in the ability to recall concrete-abstract paired-associates due to (a) imagery ability, (b) type of presentation, (c) time of testing, (d) the interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) time of testing and type of presentation.

There was no significant difference in recall due to imagery ability, type of presentation, the interaction of imagery ability and type of presentation, or the interaction of imagery ability and time of testing. Therefore, Hypotheses 3a, 3b, 3d and 3e were not rejected.

As indicated in Table 5, there was a significant difference ($F = 358.516$; df 1, 96; $\alpha < .01$) between the recall on the immediate test and recall on the delayed test. Therefore, Hypothesis 3c was rejected. The mean score for the immediate test was 4.08, for the delayed test 0.58.

Table 5

Summary Table of Analysis of Covariance for Scores on Concrete-Abstract Paired-Associates Tests

| Source | Sum of Squares (Adj. for SCAT) | df | Mean Square | F | p[a] |
|---|---|---|---|---|---|
| Imagery | .094 | 1 | .094 | .032 | ns |
| Treatment (Type of Presentation) | 4.931 | 1 | 4.931 | 1.679 | ns |
| Imagery X Treatment | 3.124 | 1 | 3.124 | 1.064 | ns |
| Error (Between) | 281.922 | 96 | 2.937 | | |
| Time | 609.118 | 1 | 609.118 | 358.516 | ** |
| Imagery X Time | 1.152 | 1 | 1.152 | .678 | ns |
| Treatment X Time | 6.872 | 1 | 6.872 | 4.045 | * |
| Error (Within) | 163.089 | 96 | 1.699 | | |

[a]F = 3.945 at .05 level
F = 6.915 at .01 level

*p < .05
**p < .01

There was also a significant difference ($F = 4.045$; df 1, 96; $\alpha < .05$) due to the interaction of time and type of presentation. Therefore, Hypothesis 3f was rejected. This interaction is indicated in Figure 4.

Those subjects who viewed the pictorial presentation recalled more ($\overline{X} = 4.40$) on the immediate test than did those students who viewed the verbal presentation ($\overline{X} = 3.67$). However, those students who viewed the verbal presentation ($\overline{X} = 0.61$) recalled more on the delayed test than did those viewing the pictorial presentation ($\overline{X} = 0.56$).

Hypotheses 4. There is no difference in the ability to recall abstract-concrete paired-associates due to (a) imagery ability, (b) type of presentation, (c) time of testing, (d) the interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) time of testing and type of presentation.

As indicated in the summary table (Table 6), there was no significant difference in recall due to imagery ability, type of presentation, the interaction of imagery ability and type of presentation, or the interaction of imagery ability and time of testing. Therefore, Hypotheses 4a, 4b, 4d and 4e were not rejected.

There was a significant difference ($F = 189.699$; df 1, 96; $\alpha < .01$) in recall due to time of testing. Therefore, Hypothesis 4c was rejected. The immediate test mean score was 3.04; the delayed test mean score was .61.

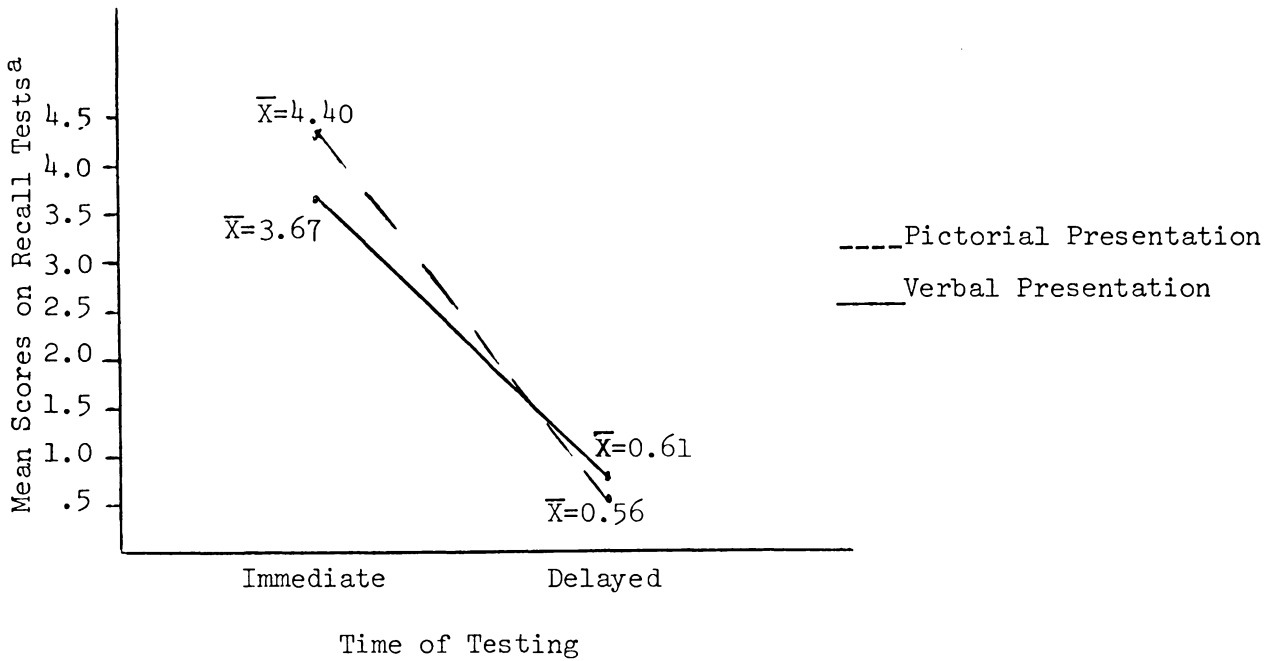



Figure 4. Effect of Interaction of Time and Treatment on Recall of concrete-abstract paired-associates.

[a]Combination of High and Low Imagers' scores

Table 6

Summary Table of Analysis of Covariance for Scores on Abstract-Concrete Paired-Associates Tests

| Source | Sum of Squares (Adj. for SCAT) | df | Mean Square | F | p[a] |
|---|---|---|---|---|---|
| Imagery | .359 | 1 | .359 | .176 | ns |
| Treatment (Type of Presentation) | 4.987 | 1 | 4.987 | 2.440 | ns |
| Imagery X Treatment | .378 | 1 | .378 | .185 | ns |
| Error (Between) | 196.238 | 96 | 2.044 | | |
| Time | 288.343 | 1 | 288.343 | 189.699 | ** |
| Imagery X Time | .001 | 1 | .001 | .001 | ns |
| Treatment X Time | 11.341 | 1 | 11.341 | 7.461 | ** |
| Error (Within) | 145.923 | 96 | 1.520 | | |

[a]F = 3.945 at .05 level
F = 6.915 at .01 level

**$p < .01$

There was also a significant difference ($F = 7.461$; df 1, 96; $\alpha < .01$) in recall due to the interaction of time of testing and the type of presentation. Therefore, Hypothesis 4f was rejected. The interaction is indicated in Figure 5.

Those students who viewed the pictorial presentation scored higher ($\bar{X} = 3.49$) on the immediate test than did those who viewed the verbal presentation ($\bar{X} = 2.47$). On the delayed test, the students who viewed the verbal presentation ($\bar{X} = 0.59$) had a less radical decrease in recall than those who had viewed the pictorial presentation ($\bar{X} = 0.63$).

Hypotheses 5. There is no difference in the ability to recall abstract-abstract paired-associates due to (a) imagery ability, (b) type of presentation, (c) time of testing, (d) the interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) time of testing and type of presentation.

There was no significant difference in the recall of the information due to imagery ability, type of presentation, interaction of imagery ability and type of presentation, interaction of imagery ability and time of testing or the interaction of time of testing and the type of presentation. Therefore, Hypotheses 5a, 5b, 5d, 5e and 5f were not rejected. As indicated in Table 7, the only significant difference ($F = 191.260$; df 1, 96; $\alpha < .01$) was between the scores on the immediate test ($\bar{X} = 2.81$) and the scores on the delayed

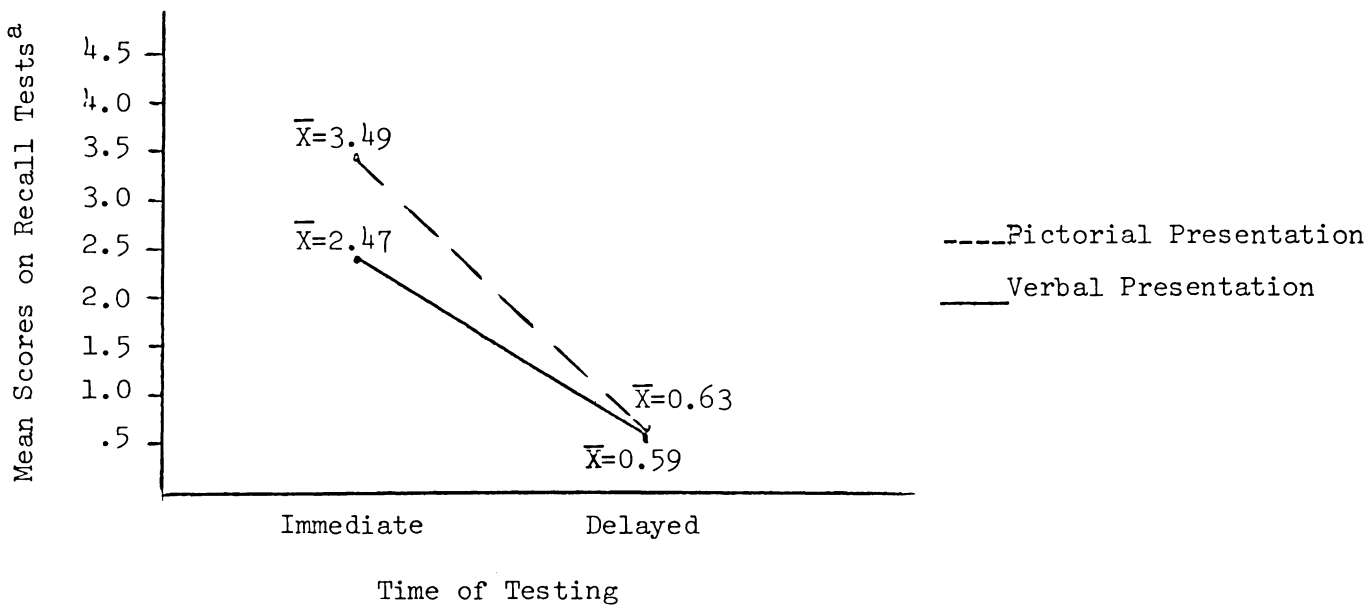



Figure 5. Effect of Interaction of Time and Treatment on Recall of abstract-concrete paired-associates.

[a]Combination of High and Low Imagers' scores

Table 7

Summary Table of Analysis of Covariance for Scores on Abstract-Abstract Paired-Associates Tests

| Source | Sum of Squares (Adj. for SCAT) | df | Mean Square | F | p[a] |
|---|---|---|---|---|---|
| Imagery | 1.510 | 1 | 1.510 | .610 | ns |
| Treatment (Type of Presentation) | .303 | 1 | .303 | .122 | ns |
| Imagery X Treatment | 4.196 | 1 | 4.196 | 1.694 | ns |
| Error (Between) | 237.829 | 96 | 2.477 | | |
| Time | 320.360 | 1 | 320.360 | 191.260 | ** |
| Imagery X Time | 3.570 | 1 | 3.570 | 2.131 | ns |
| Treatment X Time | .999 | 1 | .999 | .596 | ns |
| Error (Within) | 160.814 | 96 | 1.675 | | |

[a]F = 3.945 at .05 level
F = 6.915 at .01 level

**$p < .01$

test ($\overline{X}$ = 0.28). Therefore, Hypothesis 5c was rejected.

Hypothesis 6. There is no correlation between imagery ability and academic aptitude.

As calculated from the shortened Betts' QMI and the SCAT scores included in Appendix D, there was not a significant correlation ($r = -0.12$) between imagery ability and academic aptitude. Therefore, Hypothesis 6 was not rejected.

Summary

The multivariate analysis indicated no significant differences due to imagery ability, type of presentation or interaction.

The results of all the univariate analyses on the four categories of paired-associates indicated a significant difference between recall on the immediate test and recall on the delayed test.

In addition, on the concrete-concrete test, there was a significant interaction between imagery ability and type of presentation. On the concrete-abstract and abstract-concrete tests there were significant interactions between the type of presentation and the immediate and delayed testing.

The correlation between imagery ability and academic aptitude was -0.12.

Included in Chapter 5 are a summary of the study and its findings, a discussion based on the data analysis, and the recommendations for further research.

Chapter 5

# SUMMARY, DISCUSSION AND RECOMMENDATIONS FOR FURTHER RESEARCH

Educators have become increasingly aware of varying student abilities and disabilities to learn. One method used to try to overcome learning difficulties has been the increased use of pictorial presentations in the classroom. However, consideration has not been given to the students' inherent ability to image mentally instead of viewing a pictorial presentation as a possible alternative approach to learning.

## Summary

Purpose of the study. The purpose of this study was to determine the effect of students' varying ability to image upon their learning. The study was to consider if this ability interacted with different types of presentations, pictorial or verbal, to confuse or assist the student in learning. Specifically, the following research questions were considered:

1. What effects do imagery ability, type of presentation, namely pictorial or verbal, and interaction between imagery ability and type of presentation have on community college students' learning?

2. Do these effects differ according to the type of information presented, i.e., concrete or abstract information?

3. Is there a correlation between imagery ability and academic aptitude?

4. What effect does time have on retention?

Procedure. Community college students (N = 103) in Introductory Psychology or Human Relations classes were tested, using the shortened Betts' Questionnaire Upon Mental Imagery (QMI), to determine their ability to image mentally. Based on the scores of this test, students were divided into High Imagers and Low Imagers.

To control for intelligence, students within each imagery group were ranked according to their School and College Ability Test (SCAT) verbal aptitude score. Within each imagery group, the subjects with the two highest SCAT scores were randomly assigned, one to each treatment group. The next two highest scores within each imagery group were randomly assigned, one to each treatment group. This procedure was continued until all students were assigned to one of the treatment groups, pictorial or verbal.

Each treatment group was shown a slide presentation of twenty-eight paired-associates, which included four categories of associations, concrete-concrete, concrete-abstract, abstract-concrete, and abstract-abstract. The pictorial presentation included the paired-associates and an interactive cartoon drawing of the items named. The verbal presentation consisted of slides of the paired-associates only, and the students were instructed to image mentally an interactive picture of the items named.

The immediate recall test was a listing of the twenty-eight words shown first on the slides. The students were to supply the correct response for each stimulus word given. A delayed recall test of the same information was administered two weeks later.

The results of the immediate recall test were analyzed using a Multivariate Analysis of Covariance. The independent variables considered were imagery ability, type of presentation, and the interaction between them.

The results of the immediate and delayed tests for each category of paired-associates (concrete-concrete, concrete-abstract, abstract-concrete, and abstract-abstract) were analyzed using a Univariate Analysis of Covariance with repeated measures. The independent variables considered were (a) imagery ability, (b) type of presentation, (c) time of testing, (d) the interaction of imagery ability and type of presentation, (e) interaction of imagery ability and time of testing, or (f) time of testing and type of presentation.

The Pearson $r$ was used to determine the correlation between imagery ability and academic aptitude as measured by the shortened Betts' QMI and the SCAT verbal scores, respectively.

Findings. The multivariate analysis indicated no significant differences in recall of paired-associates due to imagery ability, type of presentation or interaction.

The results of all the univariate analyses on the four categories of paired-associates indicated a significant difference between recall on the immediate test and recall on the delayed test.

In addition, on the concrete-concrete test, there was a significant interaction between imagery ability and type of presentation. On the concrete-abstract and abstract-concrete tests, there were

significant interactions between the type of presentation and the immediate and delayed testing.

The correlation between imagery ability and academic aptitude was -0.12.

## Discussion

The limitations of this study should be noted, particularly that the experiment was conducted in one, rural community college and within existing classes.

Generally, the results of the study indicated that there were no significant differences in recall due to imagery ability, type of presentation or an interaction between them. Possibly this lack of significance may have been found because the shortened Betts' QMI may not have accurately identified High and Low Imagers at the community college level.

In the concrete-concrete category of paired-associates, a significant interaction between imagery ability and treatment was indicated. The High Imagers who viewed the pictorial presentation may have recorded mentally both the verbal label and the pictorial image. During the subsequent tests, the students may have recalled the information from either pictorial or verbal memory or both, a possibility suggested by DiVesta and others (1971), Hartman (1961), NSSE (1974), and Paivio, Rogers and Smythe (1968).

However, High Imagers who viewed the verbal presentation had the lowest average scores on the recall tests of any group. This

may have been caused by a lack of practice in using mental imagery as a mnemonic device. Their apparent ability to comply with the directions to image mentally as indicated by their scores on the shortened Betts' QMI and lack of extensive practice in the activity may have created mental confusion, thereby causing the lower scores. Also, the fact that the recall test required verbal responses instead of pictures may have created a problem for High Imagers, who might have recalled the cartoon drawing but not the exact labels. Incorrect answers on the recall test were often synonyms for the correct response. As suggested by DiVesta and others (1971), the information may have been mentally encoded in the form in which it was presented, i.e., pictorial, and confusion may have resulted when an exact verbal response was required on the test.

The Low Imagers who viewed the pictorial presentation recalled the information better than the High Imagers who viewed the verbal presentation, but not as well as the High Imagers who viewed the pictorial presentation. The experiments of DiVesta and others (1971), Hartman (1961), Paivio (1968), and Paivio, Rogers and Smythe (1968) indicated that pictures generally assist in the recall of information. Dwyer (1969), however, indicated that visuals assisted in the recall of some types of information. In the case of concrete-concrete paired-associates, the use of pictures evidently facilitated recall in the Low Imagers group.

Low Imagers who viewed the verbal presentation recalled more than any other group in the experiment. Although these results were

counter to those studies such as NSSE (1974), DiVesta and others (1971), and Paivio (1968) which indicated that the use of visuals increased recall over the use of mental imagery, the scores resulting from the experiment indicated that a verbal presentation to Low Imagers tended to be the most effective means of presenting the information and promoting learning. Although the students had been instructed to form interacting mental images of the items named, in the absence of any presented pictorial stimuli, the Low Imagers' attention may not have been distracted from the words, and they might have used other types of mnemonic devices such as sentence formation to facilitate recall.

The differences due to time (immediate and delayed recall) were significant in all four categories of paired-associates. The delay of two weeks may have been too long to provide much of an indication of the effects of imagery ability and type of presentation on long-term memory. An examination of the delayed test scores indicated that most students had forgotten almost all of the information. Further experimentation in this area should include a series of delayed tests, given at varying intervals from a delay of an hour up to two weeks. An experiment including such delayed testing might provide a better indication of the long-term effects of imagery ability, type of presentation and any interaction between them.

In the recall of concrete-abstract paired-associates, there was a significant difference in recall between the immediate post-test and the delayed post-test and also the interaction of the type of

presentation and time. Although students in both presentations had lower scores on the delayed test, those students who had viewed the verbal presentation recalled slightly more. The lower recall of those students who had viewed the pictorial presentation may have been caused by the necessity of a verbal response. Students who may have encoded the picture were required to decode from the picture to the verbal label in order to provide the correct response; those students who may have encoded only a verbal label were required to remember only that word in order to provide a correct response. Dwyer (1969), Levie and Levie (1974) and Sheehad (1967c) suggested that errors in recall may be caused by encoding information to recall it in another form, such as a written response. Hartman (1961) suggested that parallel presentation and testing situations might increase the amount of learning demonstrated. Further research incorporating this suggestion might provide substantiation for this hypothesis.

The recall of abstract-concrete paired-associates followed the same pattern as the recall of concrete-abstract pairs, in that significant differences were evident between the immediate and delayed testing and in the interaction of time and treatment. In this instance, however, the delayed mean test score of those students who had viewed the verbal presentation was slightly (.04) lower than the mean of the students who had viewed the pictorial presentation. The fact that students who viewed and encoded the verbal presentation forgot less than those who viewed the pictorial presentation indicated the pictures may not necessarily promote long-term memory as suggested by Paivio (1968). The active involvement of those

students trying to image during the verbal presentation may have caused the lower loss of memory over the two week delay.

The analysis of the abstract-abstract test results indicated a significant difference only between the immediate and delayed tests. The lack of significant differences due to imagery ability, treatment, or interaction may have been caused by the difficulty incurred by students trying to image abstract material. This difficulty is evident in all levels of imagers (DiVesta and others, 1971).

Generally, the experiment indicated no main effects due to imagery ability or type of treatment. The only main effect which was significant was time. Possibly because of the long delay period, two weeks, the scores on the delayed post-test tended to be low. Forty-two percent of the students scored 1 or 0 as the total score out of a possible 28 on the delayed test. More accurate conclusions concerning the effects of imagery ability, type of presentation and interaction might be drawn from a study which included a series of recall tests delayed for varying periods of time.

Low Imagers had higher recall in all four categories of paired-associates. Their scores, however, were not significantly higher than the scores of the High Imagers. Possibly the effects of imagery ability on learning would have been more evident if the sample had included only very high imagers (scores from 35 to 95 on the shortened Betts' QMI) and very low imagers (scores from 185 to 245 on the shortened Betts' QMI). In this experiment, a division such as this would have identified too small a sample (N = 33) to analyze

properly.

Although those students who viewed the pictorial presentation scored consistently higher, there was not a significant difference in recall due to the type of presentation. This result may have been caused by the type of material presented or the means of testing, but the inference is that, in presenting information, the use of a picture may not necessarily promote higher learning levels.

The low correlation between imagery ability and academic aptitude may have indicated the need for individual testing to determine imagery ability level, if consideration were to be given to the use of mental imagery as a learning skill.

## Recommendations

Recommendations for further research, some of which have been discussed previously, are as follows:

1. There should be a replication of this study using more community colleges and different levels of subjects (i.e., adults and high school students) to provide further indications of the validity of the results.

2. A test to determine the ability to image should be developed or adapted for use with community college students.

3. Experiments concerning the effects of imagery ability on learning should be conducted using only very High and very Low Imagers as subjects to provide indications of the viability of imagery as a learning skill.

4. Experiments should be conducted comparing instructions and other mnemonic devices to indicate better methods of promoting recall.

5. Experiments concerning imagery ability and type of presentation should be conducted with delayed recall tests being given after varying intervals, to determine the effects of imagery ability and presentation on long-term memory.

6. There should be experiments designed with parallel and non-parallel, pictorial and verbal, presentation and testing methods, to determine if there is a difference in learning demonstrated in these situations.

7. Experimental research should be continued on learning styles of community college students to provide indications of the methods most effective in promoting learning.

# BIBLIOGRAPHY

Anderson, J. Visualization and verbalization as mediators of thought. Speech Monographs, 1974, 41, 408-412.

Atwood, G. An experimental study of visual imagination and memory. Cognitive Psychology, 1971, 2 (3), 290-299.

Baker, S. R., and Talley, L. The relationship of visualization skills to achievement in freshman chemistry. Journal of Chemical Education, 1972, 49 (11), 775-776.

Bell, J. R. A historical overview of educational media in higher education. Audiovisual Instruction, 1975, 20 (1), 11-13.

Betts, G. H. The distribution and functions of mental imagery. New York: Teachers College, Columbia University, 1909.

Bower, G. H. Imagery as a relational organizer in associative learning. Journal of Verbal Learning and Verbal Behavior, 1970, 9, 529-533.

Bower, G. H. Mental imagery and associative learning. In L. W. Gregg (Ed.), Cognition in learning and memory. New York: John Wiley and Sons, Inc., 1972.

Bower, G. H. Mental imagery and memory. Unpublished colloquium talk, May, 1967.

Bugelski, B. R. Words and things and images. American Psychologist, 1970, 25, 1002-1012.

Bugelski, B. R., Kidd, E., and Segmen, J. Image as a mediator in one-trial paired-associate learning. Journal of Experimental Psychology, 1968, 76, 69-73.

Cross, K. P. Beyond the open door. San Francisco: Jossey-Bass, 1971.

Cross, K. P. Commentary: Meeting the needs of blue-collar and rural youth. In L. Hall and others (Eds.), New colleges for new students. San Francisco: Jossey-Bass, 1974.

Davis, J. C. The functional significance of imagery differences. Journal of Experimental Psychology, 1932, 15, 630-661.

Debes, J. L., and Williams, C. M. Power of visuals. Instructor, 1974, 84, 31-38.

Di Vesta, J. G., and others. Project Ikon: Instructional strategies. State College, Pa.: Penn State University, 1971. (ERIC Document Reproduction Service No. ED 055 447)

Dwyer, F. M. Experiment in visual communication. Journal of Research in Science Teaching. 1969, 6 (2), 185-195.

Dwyer, F. M. The relationship among theory, research and practice. Audiovisual Instruction, 1975, 20 (1), 8, 10.

Dwyer, F. M. When visuals are not the message. Educational Broadcasting Review, 1968, 2 (5), 38-43.

Elliott, L. Imagery vs. repetition encoding in short and long-term memory. Journal of Experimental Psychology, 1973, 100 (2), 270-276.

Eoff, J. E., and Rohwer, W. D., Jr. A developmental study of imagery instructions in noun-pair learning. Paper presented to American Educational Research Association, Chicago, April, 1972. (ERIC Document Reproduction Service No. ED 059 027)

Epstein, W., Rock, I., and Zuckerman, C. B. Meaning and familiarity in associative learning. Psychological Monographs, 1960, 74 (4, Whole No. 491).

Evans, I. M., and Kamemoto, W. S. Reliability of the short form of Betts' Questionnaire on Mental Imagery: Replication. Psychological Reports, 1973, 33, 281-282.

Goldberg, F. Effects of imagery on learning incidental material in the classroom. Journal of Educational Psychology, 1974, 66 (2), 233-237.

Griffith, D., and Johnston, W. A. An information-processing analysis of visual imagery. Journal of Experimental Psychology, 1973, 100 (1), 141-146.

Haith, M. M. Developmental changes in visual information processing and short-term memory. Human Development, 1971, 14 (4), 249-261.

Hartman, F. R. Single and multiple channel communication. Audio-visual Communication Review, 1961, 9 (6), 235-262.

Horowitz, M. J. Visual imagery and cognitive organization. American Journal of Psychiatry, 1967, 123 (8), 938-946.

Juhasz, J. B. On the reliability of two measures of imagery. Perceptual and Motor Skills, 1972, 35, 874.

Karl, H. Media literacy: The right to know. English Journal, 1974, 63, 7-9.

Leibovitz, M. P., and others. Dominance in mental imagery. Educational and Psychological Measurements, 1972, 32 (3), 679-703.

Levie, W. H., and Levie, D. D. Is there a separate visual iconic memory system? Final Report. Bloomington, Indiana: Indiana University, 1974. (ERIC Document Reproduction Service No. ED 095 519)

Levin, J. R., and others. Verbal facilitation of paired-associate learning: a limited generalization? Journal of Educational Psychology, 1971, 62, 439-444.

Marks, D. F. Individual differences in the vividness of visual imagery and their effect on function. In P. W. Sheehan (Ed.) The function and nature of imagery. New York: Academic Press, 1972.

Marks, D. F. Visual imagery differences in the recall of pictures. British Journal of Psychology, 1973, 64 (1), 17-24.

McCall, J., and Rae, G. Relative efficiency of visual, auditory and combined modes of presentation in learning of paired-associates. Perceptual and Motor Skills, 1974, 38 (3), 955-958.

McKellar, P. The investigation of mental images. In S. A. Barnett and A. McLaren (Eds.), Penguin Science Survey. B. Harmandsworth, England: Penguin Books, 1965.

Moldstad, J. A. Selective review of research studies showing media effectiveness. AV Communication Review, 1974, 22 (4), 387-407.

National Society for the Study of Education. Media and symbols. Chicago: National Society for the Study of Education, 1974.

Neisser, U. Changing conceptions of imagery. In P. W. Sheehan (Ed.), The function and nature of imagery. New York: Academic Press, 1972.

Paivio, A. Abstractness, imagery, and meaningfulness in paired-associate learning. Journal of Verbal Learning and Verbal Behavior, 1965, 4, 32-38.

Paivio, A. Imagery and verbal processes. New York: Holt, Rinehart and Winston, Inc., 1971.

Paivio, A. Learning of adjective-noun paired-associates as a function of adjective-noun word order and noun abstractness. Canadian Journal of Psychology, 1963, 17, 370-379.

Paivio, A. On the functional significance of imagery. Psychological Bulletin, 1970, 73 (6), 385-392.

Paivio, A., and Olver, M. Denotative generality, imagery, and meaningfulness in paired-associate learning of nouns. Psychonomic Science, 1964, 1 (7), 183-184.

Paivio, A., and Yarmey, A. Pictures versus words as stimuli and responses in paired-associate learning. Psychonomic Science, 1966, 5, 235-236.

Paivio, A., Rogers, T. B., and Smythe, P. C. Why are pictures easier to recall than words? Psychonomic Science, 1968, 11, 137-138.

Paivio, A., Smythe, P. C., and Yuille, J. C. Imagery versus meaningfulness of nouns in paired-associate learning. Canadian Journal of Psychology, 1968, 22, 427-441.

Paivio, A., Yuille, J. C., and Madigan, S. A. Concreteness, imagery, and meaningfulness values for 925 nouns. Journal of Experimental Psychology Monograph, 1968, 76 (1, Pt. 2).

Palermo, D. S. Imagery in children's learning. Psychological Bulletin, 1970, 73 (6), 415-421.

Peterson, M. J., and Murray, A. Enhancing items and associations by imagery. Journal of Experimental Psychology, 1973, 101 (1), 82-89.

Porcher, L. Some assessment studies. Educational Media International, 1972, 2 (2), 13-16.

Posner, M. I., and Konick, A. F. Short-term retention of visual and kinesthetic information. Organizational Behavior and Human Performance, 1966, 1, 71-86.

Rimm, D. C., Alexander, R. A., and Eiles, R. R. Effects of different mediational instructions and sex of subject on paired-associate learning of concrete nouns. Psychological Reports, 1969, 25, 935-940.

Rohwer, W. D. Images and pictures in children's learning. Psychological Bulletin, 1970, 73 (6), 393-403.

Roueche, J. E., and Kirk, R. W. Catching up: Remedial education. San Francisco: Jossey-Bass, 1973.

Ryan, T. A., and Schwartz, C. B. Speed of perception as a function of mode of presentation. American Journal of Psychology, 1956, 69, 60-69.

Saettler, P. A history of instructional technology, New York: McGraw-Hill Book Company, 1968.

Seiler, W. J. Effects of visual materials on attitudes, credibility and retention. Speech Monographs, 1971, 38, 331-334.

Severin, W. J. Pictures as relevant cues in multi-channel communications. Journalism Quarterly, 1967, 44, 17-22.

Sheehan, P. W. The Betts' QMI vividness of imagery scale. Mimeographed article, 1975.

Sheehan, P. W. Functional similarity of imaging to perceiving: Individual differences in vividness of imagery. Perceptual and Motor Skills, 1966, 23, 1011-1033.

Sheehan, P. W. Reliability of a short test of imagery. Perceptual and Motor Skills, 1967, 25, 744. (b)

Sheehan, P. W. A shortened form of Betts' Questionnaire Upon Mental Imagery. The Journal of Clinical Psychology, 1967, 23, 386-389. (a)

Sheehan, P. W. Visual imagery and the organizational properties of perceived stimuli. British Journal of Psychology, 1967, 58 (3-4), 247-252. (c)

Smith, K. U., and Smith, M. F. Cybernetic principles of learning and educational design. New York: Holt, Rinehart and Winston, Inc., 1966.

Spaulding, S. Research on pictorial illustration. AV Communication Review, 1955, 3, 35-45.

Stewart, J. C. Experimental investigation of imagery. Unpublished doctoral dissertation, University of Toronto, 1965.

Tanzman, J. Meaning and importance of visual literacy. School Management, 1972, 16, 41.

Thorndike, E. L., and Lorge, I. The teacher's word book of 30000 words. New York: Teachers College, Columbia University, 1944.

Travers, R. M. W. Theory of perception and the design of audiovisual materials. Paper presented to Educational Medial Seminar, Lewisburg, Pa., Bucknell University, 1968.

Van Mondfrans, A. P., and Travers, R. M. W. Learning of redundant material presented through two sensory modalities. Perceptual and Motor Skills, 1964, 19, 743-751.

Wendt, P. The language of pictures. ETC. A Review of General Semantics, 1956, 8, 281-288.

Yarmey, A., and Paivio, A. Further evidence on the effects of word abstractness and meaningfulness in paired-associate learning. Psychonomic Science, 1965, 2, 307-308.

# APPENDIX A

## SHORTENED BETTS' QUESTIONNAIRE UPON MENTAL IMAGERY

Social Security No. _____
Name (optional) _____

THE BETTS QMI VIVIDNESS OF IMAGERY SCALE

Instructions for Doing Test

The aim of this test is to determine the vividness of your imagery. The items of the test will bring certain images to your mind. You are to rate the vividness of each image by reference to an accompanying rating scale, reproduced below and on top of the next page. For example, if your image is "vague and dim" you give it a rating of 5.

Before turning to items on the next pages, familiarize yourself with the different rating scale categories printed below and on top of the following page. Please do not leave any page until you have completed the items on the page you are doing, and do not go back to check on completed items. Complete each set before moving on to the next set. Try to do each item separately, independently of how you may have done other items.

---

The image aroused by an item of this test may be -

| | |
|---|---|
| Perfectly clear and as vivid as the actual experience . . | Rating 1 |
| Very clear and comparable in vividness to the actual experience . . . . . | Rating 2 |
| Moderately clear and vivid . . . . . | Rating 3 |
| Not clear or vivid, but recognizable . . . . . | Rating 4 |
| Vague and dim . . . . . | Rating 5 |
| So vague and dim as to be hardly discernable . . . . . | Rating 6 |
| No image present at all, you only "knowing" that you are thinking of the object . . . . . | Rating 7 |

---

An example of an item on the test would be one which asked you to consider an image which comes to your mind's eye of a red apple. If your visual image was moderately clear and vivid you would check the rating scale and mark "3" on the prepared answer sheet.

Now turn to the next page when you have understood these instructions and begin the test.

Here is the rating scale again in brief:

| | | | |
|---|---|---|---|
| Perfectly clear and vivid: | Rating 1 | Vague and dim: | Rating 5 |
| Very clear: | Rating 2 | Hardly discernable: | Rating 6 |
| Moderately clear: | Rating 3 | No image at all: | Rating 7 |
| Recognizable: | Rating 4 | | |

Think of some relative or friend whom you frequently see, considering carefully the picture that rises before your mind's eye. Classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

| Item | | Rating |
|---|---|---|
| 1. | The exact contour of face, head, shoulders and body . . | ( ) |
| 2. | Characteristic poses of head, attitudes of body, etc. . | ( ) |
| 3. | The precise carriage, length of step, etc. in walking . | ( ) |
| 4. | The different colours worn in some familiar costume . . | ( ) |

Think of seeing each of the following, considering carefully the picture which comes before your mind's eye; and classify the image suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

5. The sun as it is sinking below the horizon . . . . . ( )

Think of each of the following sounds, considering carefully the image which comes to your mind's ear, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

| Item. | | |
|---|---|---|
| 6. | The whistle of a locomotive . . . . . | ( ) |
| 7. | The honk of an automobile . . . . . | ( ) |
| 8. | The meowing of a cat. . . . . | ( ) |
| 9. | The sound of escaping steam . . . . . | ( ) |
| 10. | The clapping of hands in applause . . . . . | ( ) |

Think of "feeling" or touching each of the following, considering carefully the image which comes to your mind's touch, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

| Item. | | |
|---|---|---|
| 11. | Sand . . . . . | ( ) |
| 12. | Linen . . . . . | ( ) |
| 13. | Fur . . . . . | ( ) |
| 14. | The prick of a pin . . . . . | ( ) |
| 15. | The warmth of a tepid bath . . . . . | ( ) |

Think of performing each of the following acts, considering carefully the image which comes to your mind's arms, legs, lips, etc., and classify the images suggested as indicated by the degree of clearness and vividness specified on the Rating Scale.

| Item. | | Rating |
|---|---|---|
| 16. | Running upstairs . . . . . | ( ) |
| 17. | Springing across a gutter . . . . . | ( ) |
| 18. | Drawing a circle on paper . . . . . | ( ) |
| 19. | Reaching up to a high shelf . . . . . | ( ) |
| 20. | Kicking something out of your way . . . . . | ( ) |

Think of tasting each of the following considering carefully the image which comes to your mind's mouth, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

| Item. | | |
|---|---|---|
| 21. | Salt . . . . . | ( ) |
| 22. | Granulated (white) sugar . . . . . | ( ) |
| 23. | Oranges . . . . . | ( ) |
| 24. | Jelly . . . . . | ( ) |
| 25. | Your favourite soup . . . . . | ( ) |

Think of smelling each of the following, considering carefully the image which comes to your mind's nose and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

| Item. | | |
|---|---|---|
| 26. | An ill-ventilated room . . . . . | ( ) |
| 27. | Cooking cabbage . . . . . | ( ) |
| 28. | Roast beef . . . . . | ( ) |
| 29. | Fresh paint . . . . . | ( ) |
| 30. | New leather . . . . . | ( ) |

Think of each of the following sensations, considering carefully the image which comes before your mind, and classify the images suggested as indicated by the degrees of clearness and vividness specified on the Rating Scale.

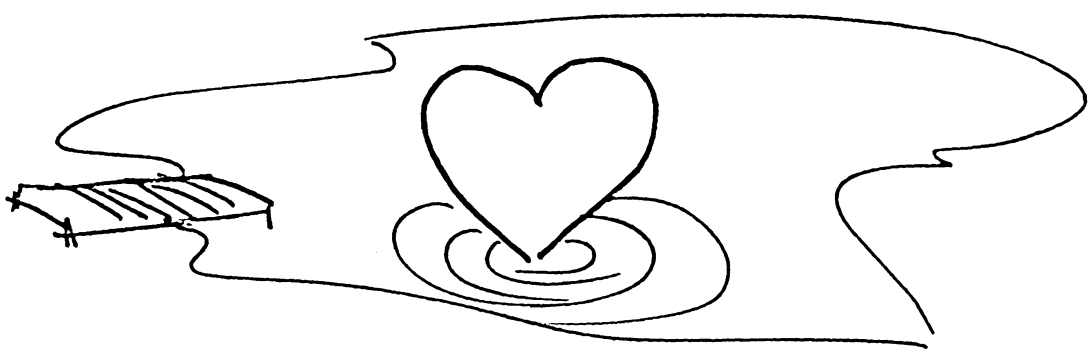
| Item. | | |
|---|---|---|
| 31. | Fatigue . . . . . | ( ) |
| 32. | Hunger . . . . . | ( ) |
| 33. | A sore throat . . . . . | ( ) |
| 34. | Drowsiness . . . . . | ( ) |
| 35. | Repletion as from a very full meal . . . . . | ( ) |

# APPENDIX B

## ORIGINAL DRAWINGS AND LABELS FOR PICTORIAL PRESENTATION

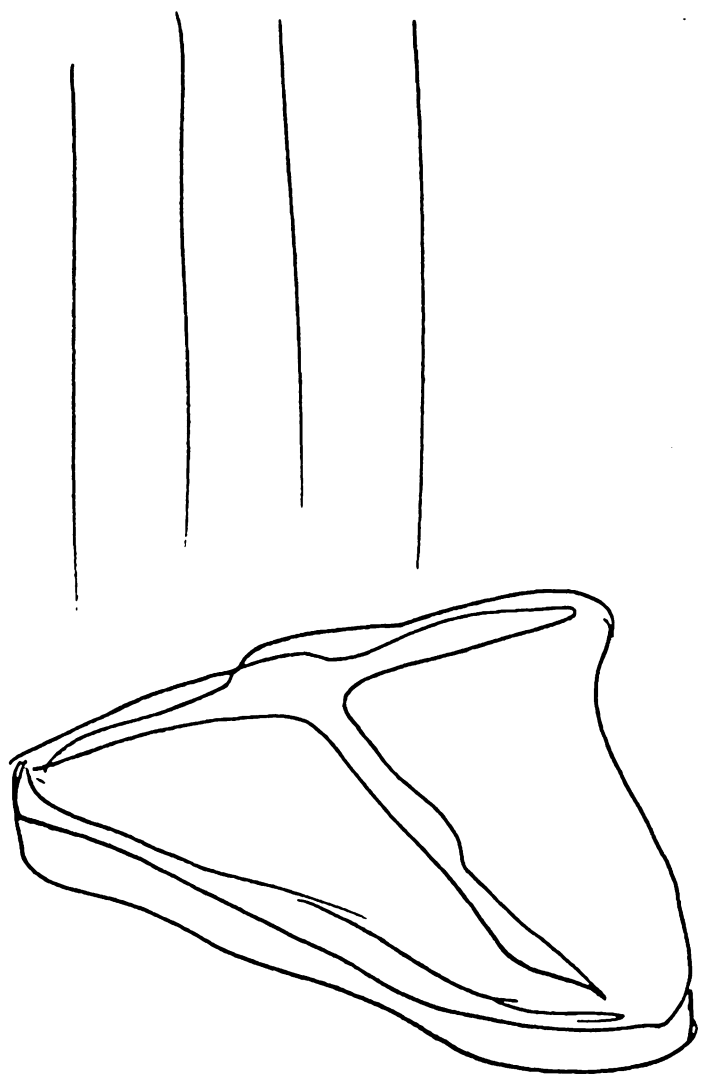
Love

Lake



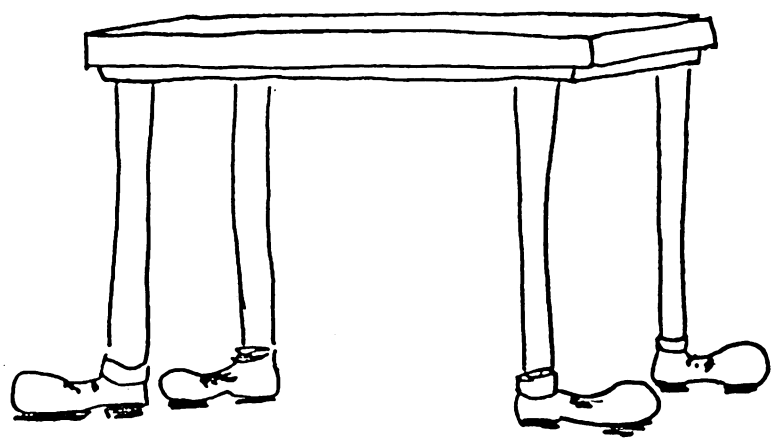
Meat

Gravity



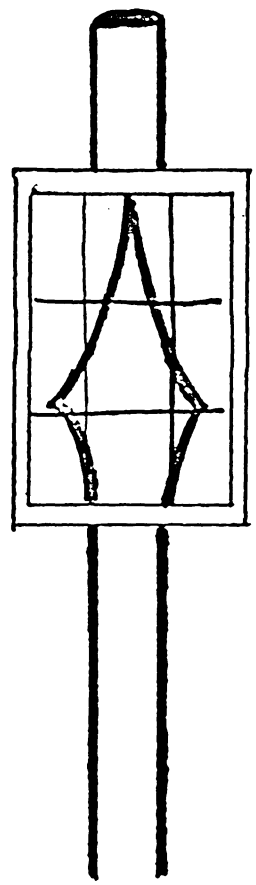
Shoes

Table



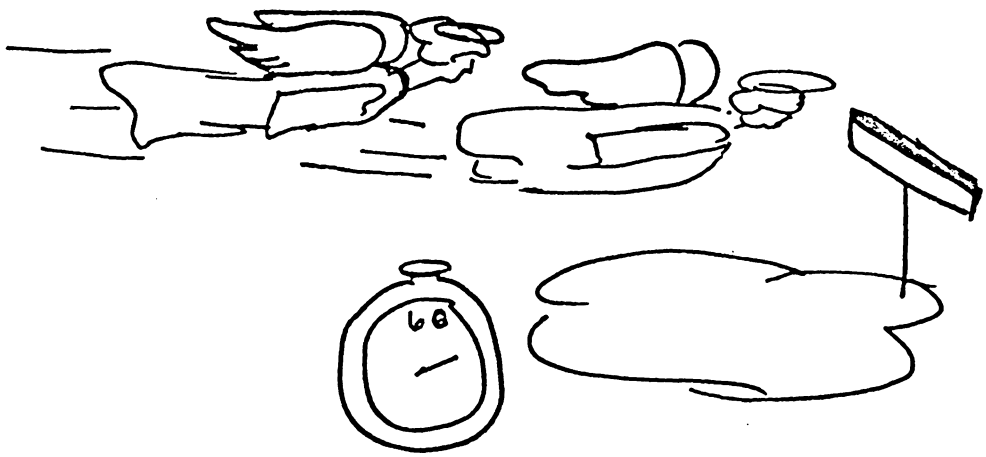
Pole

Window

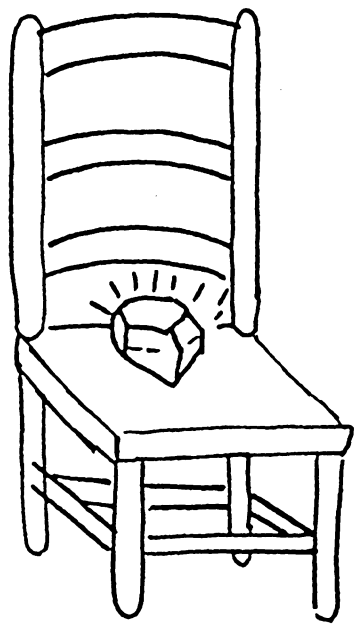


Virtue

Time

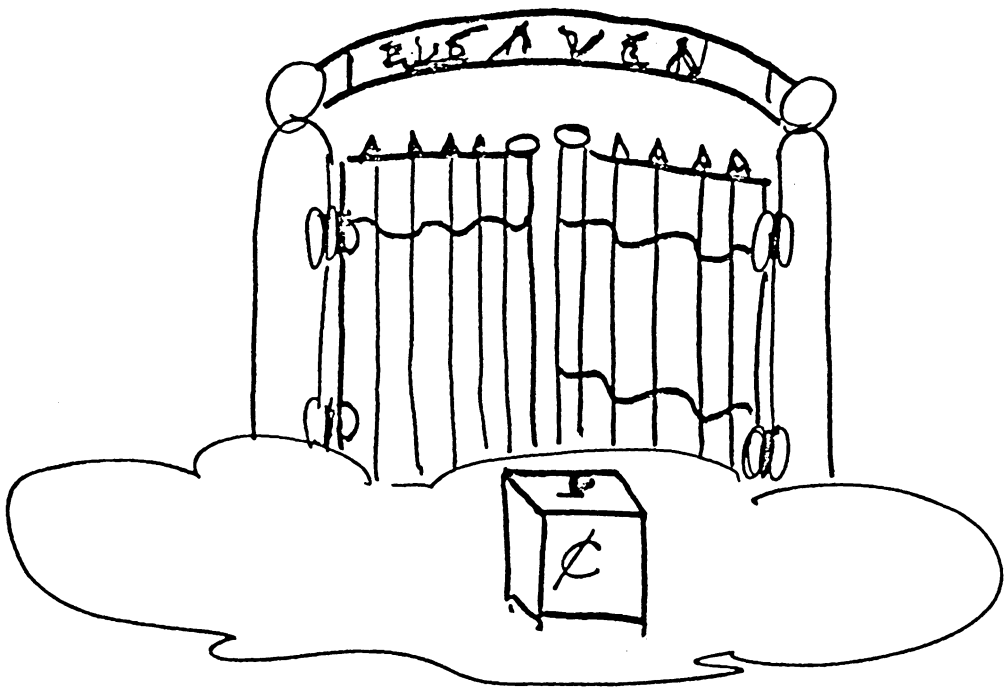


Diamond
Chair



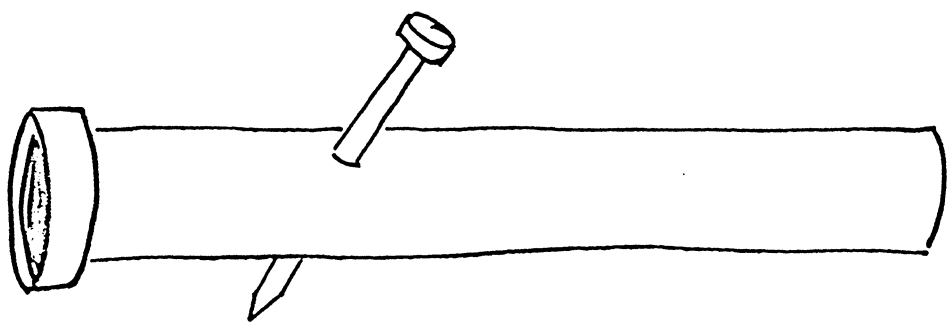
Coin

Heaven



Nail

Pipe

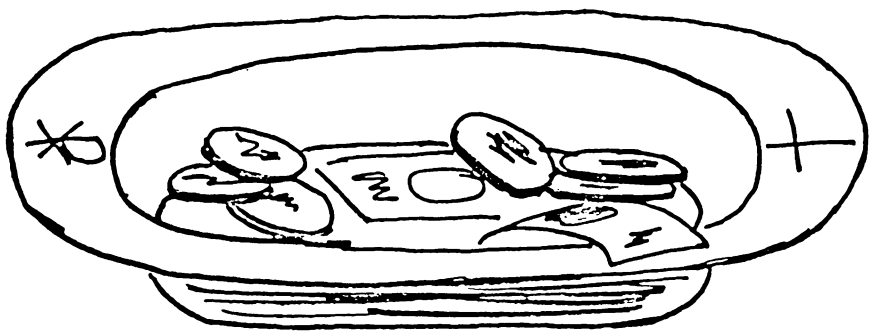


Theory

Corn

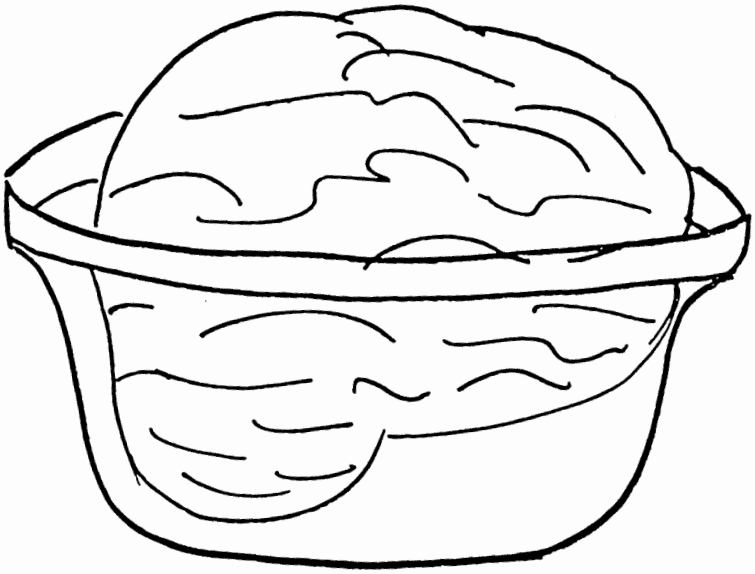
Economy

Devotion

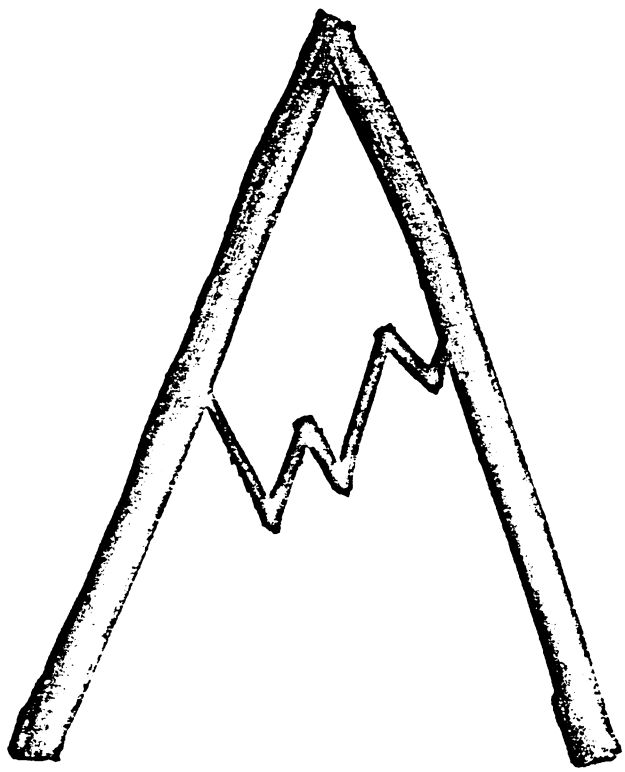


Bowl

Mind

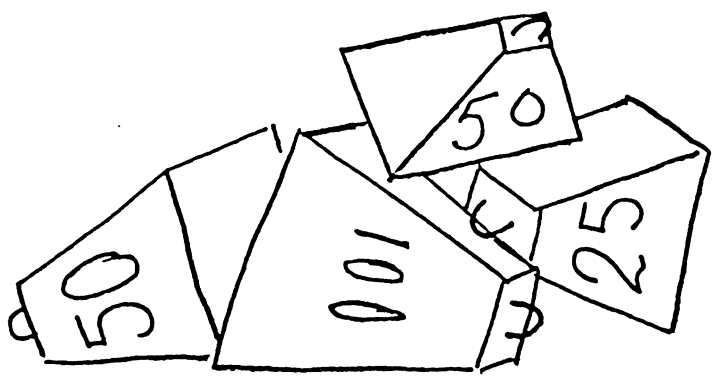


Quality
Mountain

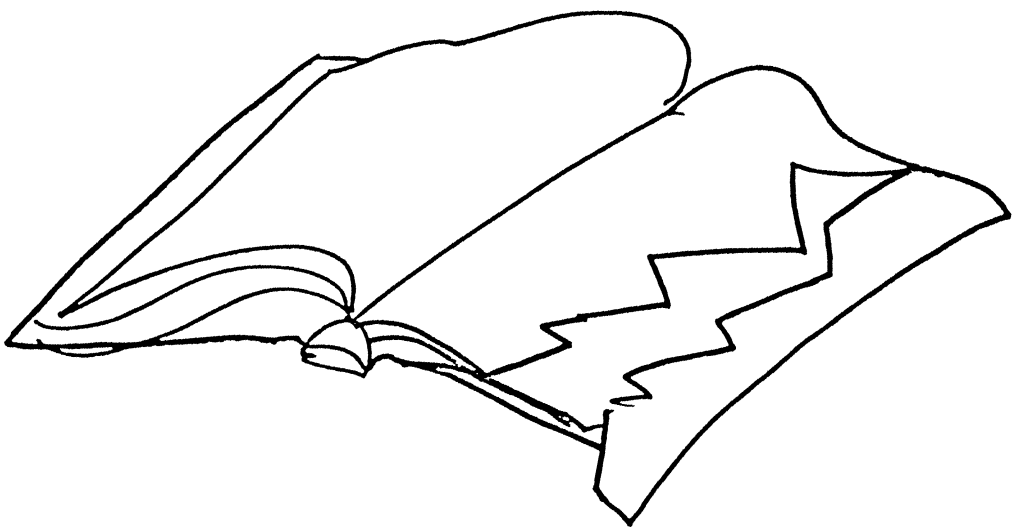


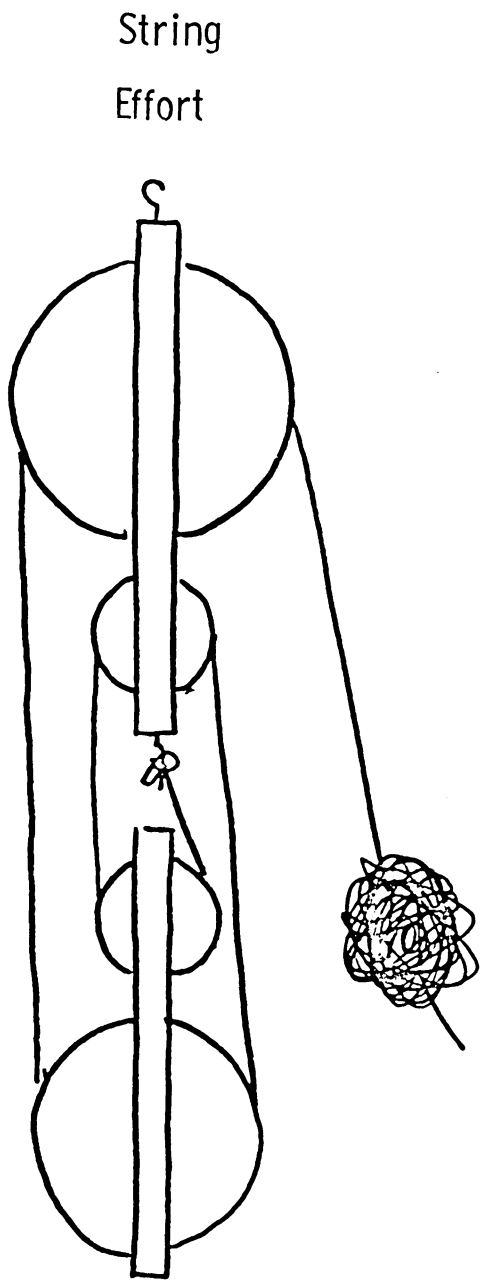
Chaos

Strength



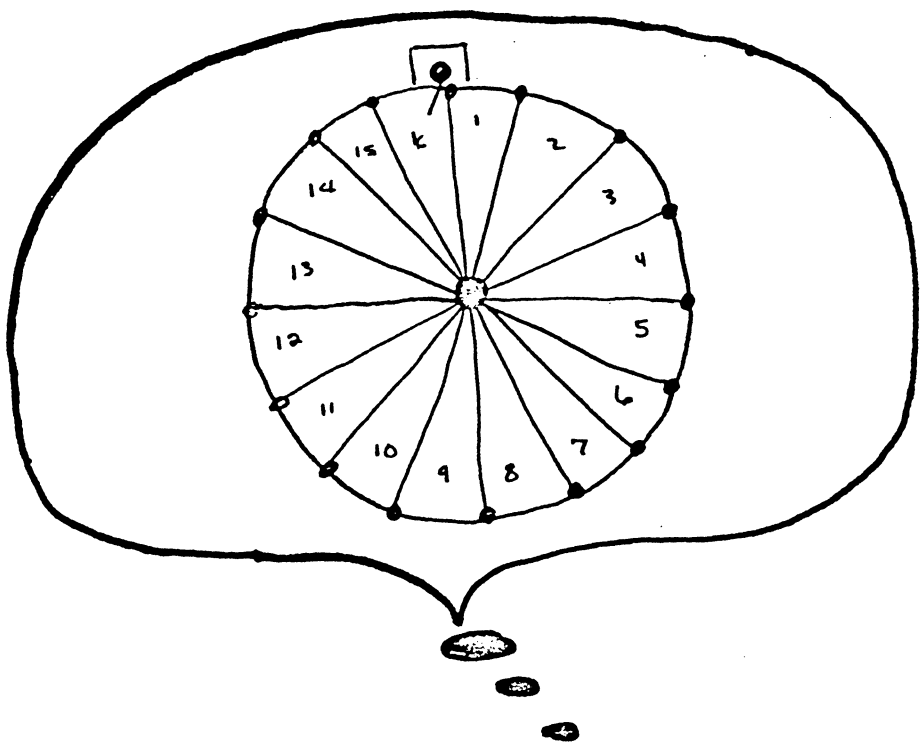
Trouble
Book




String
Effort

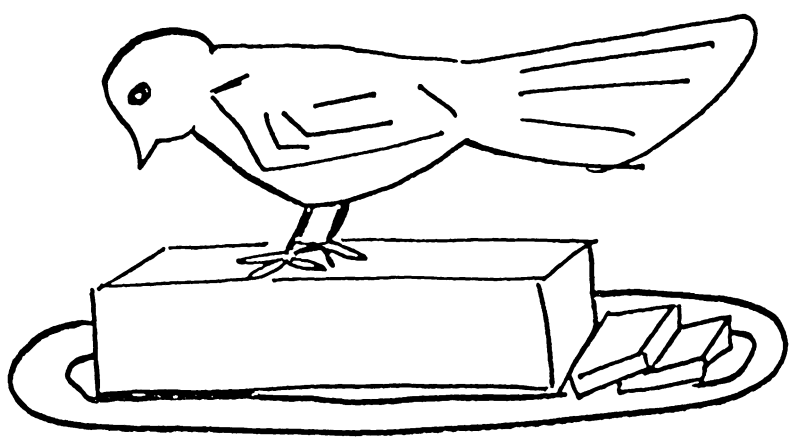
Idea

Chance



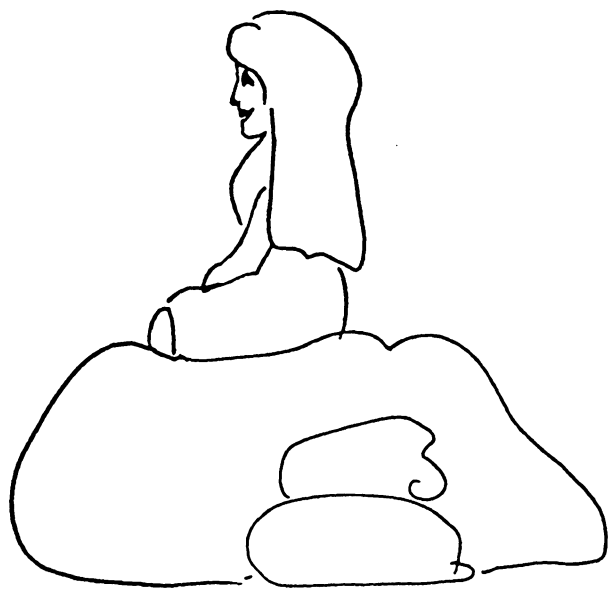
Butter

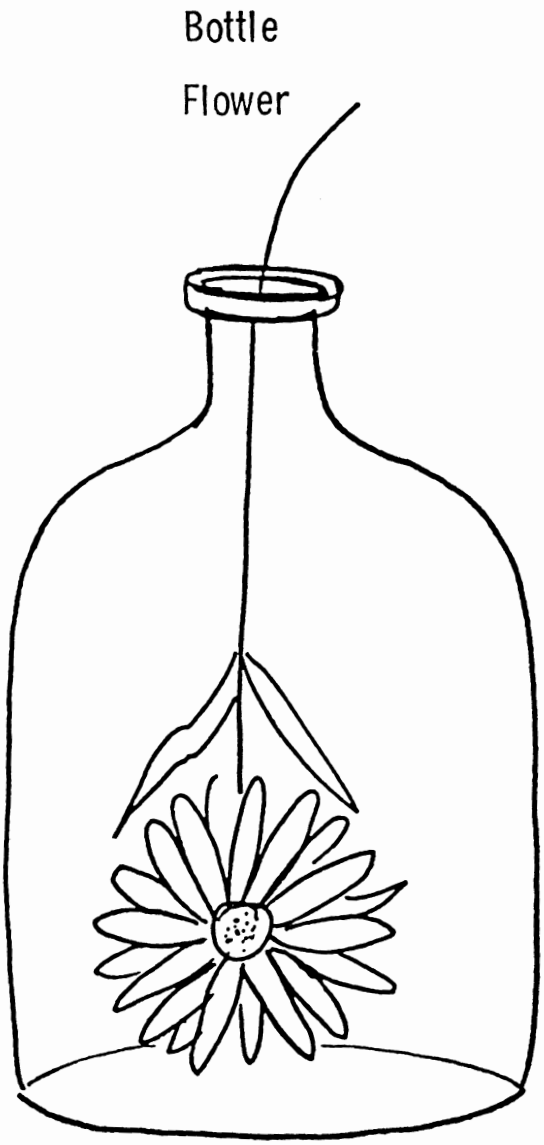
Bird



Pleasure

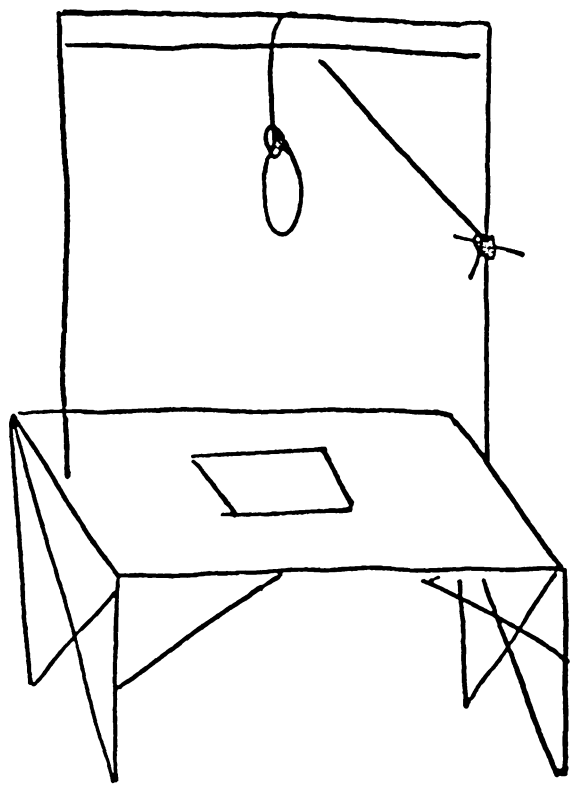
Stone




Bottle
Flower

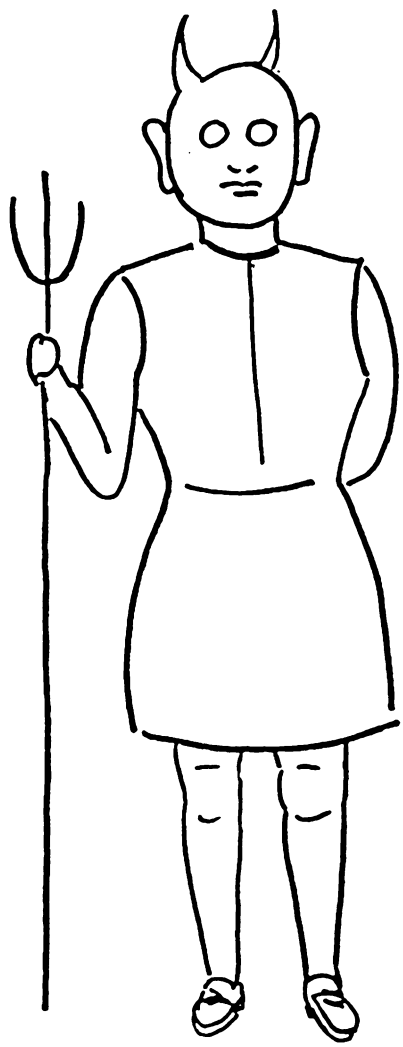
Justice

Death



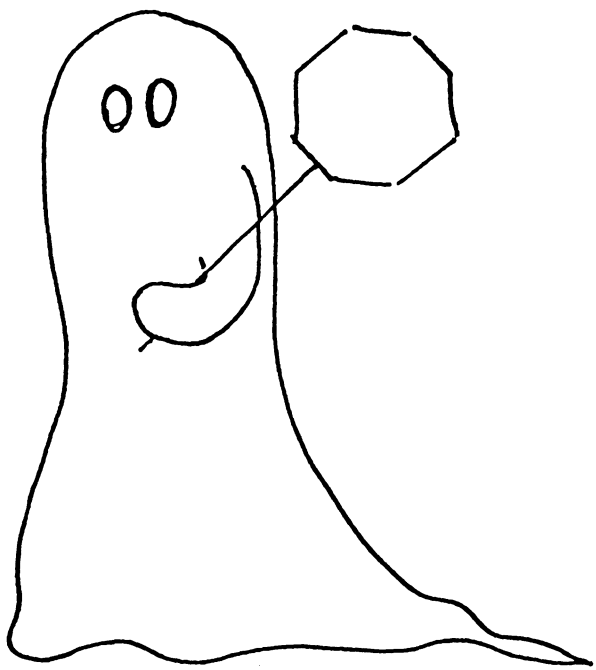
Dress

Devil



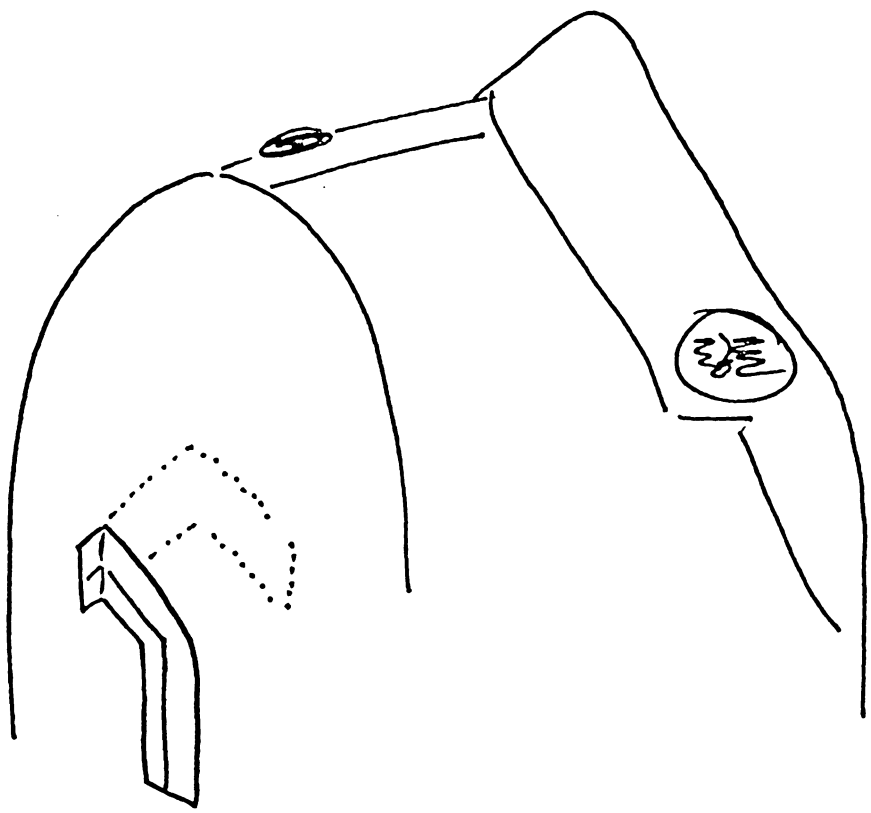
Safety

Spirit



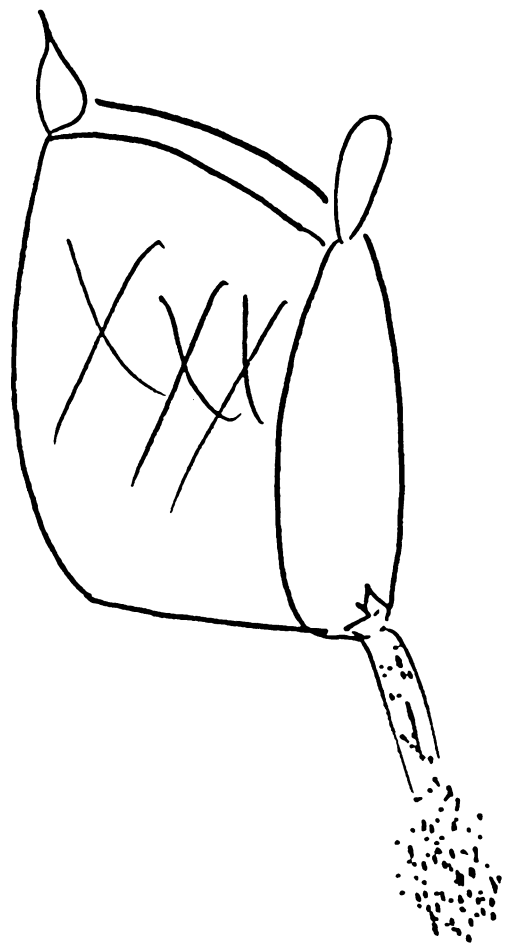
Duty

Shame



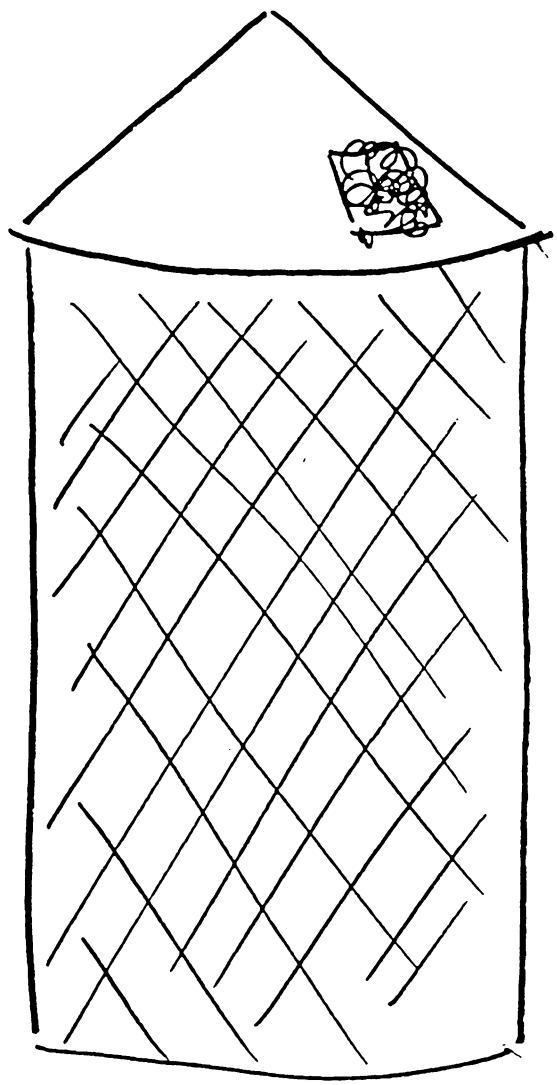
Sugar

Freedom



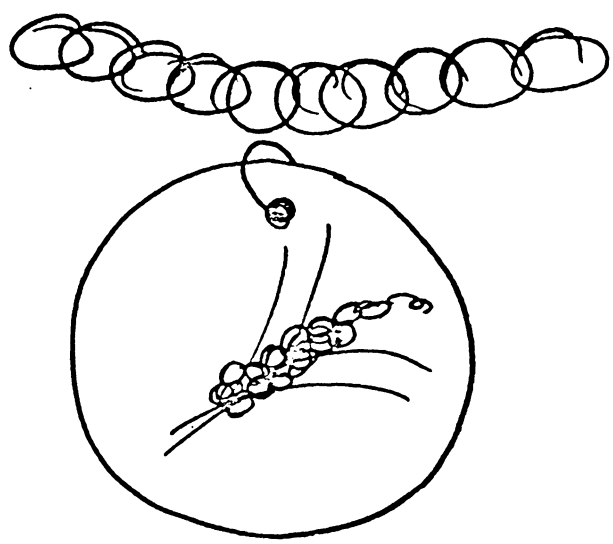
Capacity

Tower



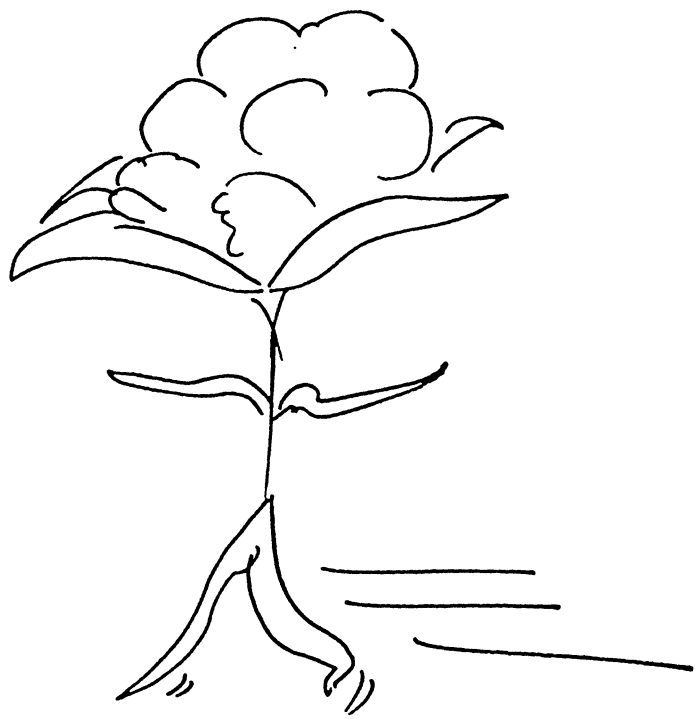
Wheat

Charm



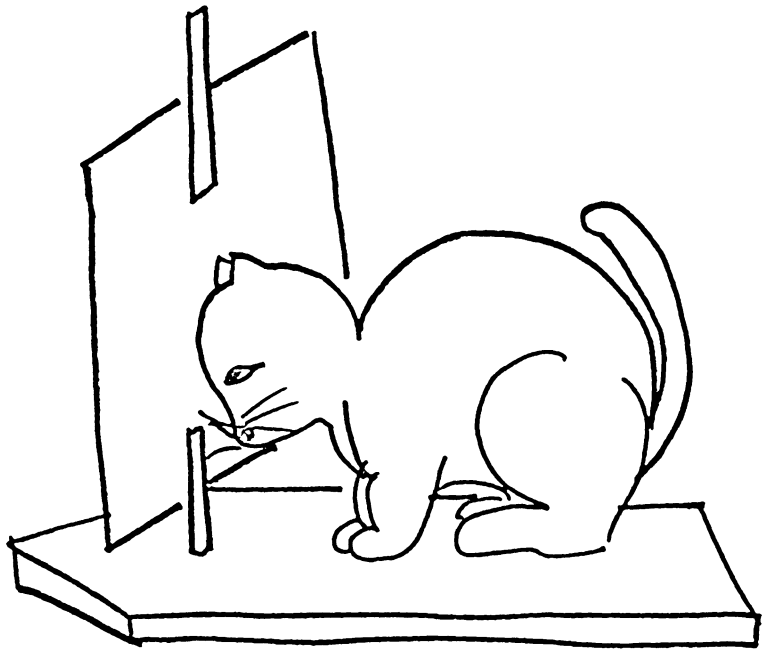
Life

Cotton



Ship

Cat



# APPENDIX C

## INSTRUCTIONS AND DRAWINGS OF EXAMPLES PRECEDING PICTORIAL AND VERBAL PRESENTATIONS

Pictorial Presentation

This is an experiment to determine how your ability to mentally picture information effects your learning.

You will be shown slides of several pairs of words such as DOG-BICYCLE plus a drawing of the two items named. The picture will be a cartoon drawing of the two items in an interacting situation, that is, as in this example, the dog is riding the bicycle.

Let's look at several other examples:

UMBRELLA-TRAGEDY

MULTIPLICATION-APPLE

CLEANNESS-COST

TABLESPOON-WOODS

Each slide will be shown for a limited period of time. After all the slides are shown, you will be given a list of the words which appeared first in each pair like this. That is, using the examples again, you will receive a list of Umbrella, Multiplication, Cleanness and Tablespoon. You will be expected to supply the word that was shown on the slide with the word given. Beside umbrella you would write what? (pause) Tragedy. Beside multiplication_____? (pause) Apple; cleanness_____? (pause) Cost, and beside tablespoon_____? (pause) Woods. In order to help yourself remember the word you are trying to recall, try to picture the drawing shown with the words.

After you have completed the recall test, please turn your paper over and remain seated until the rest of the group is finished.

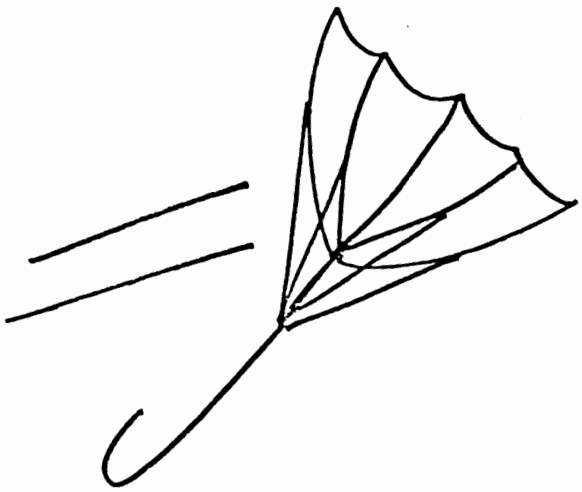
Are there any questions?

Dog

Bicycle

Umbrella

Tragedy

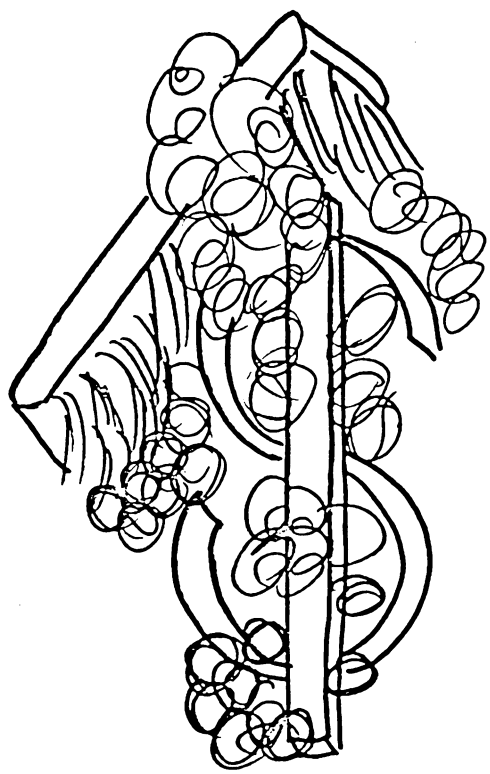


Multiplication

Apple

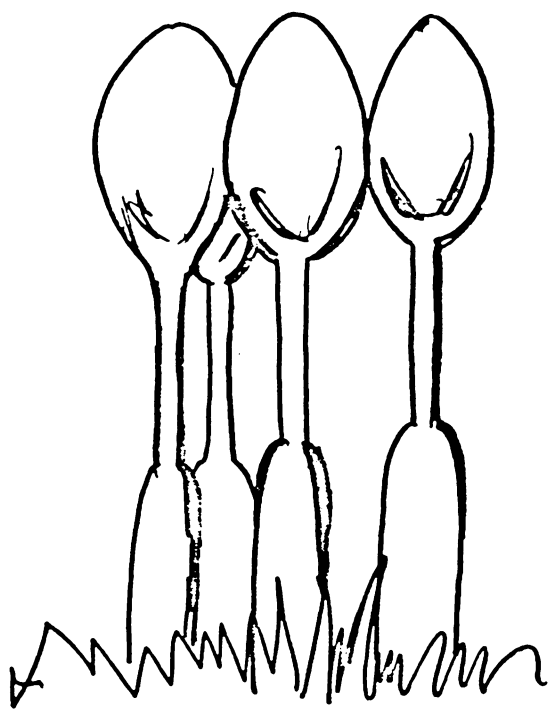
Cleanness

Cost



Tablespoon

Woods



Verbal Presentation

This is an experiment to determine how your ability to mentally picture information effects your learning.

You will be shown slides of several pairs of words, such as DOG-BICYCLE. In order to help you remember the words, mentally picture the two items interacting. As in this example, you might mentally picture a dog riding a bicycle.

Let's consider several other examples:

UMBRELLA-TRAGEDY

MULTIPLICATION-APPLE

CLEANNESS-COST

TABLESPOON-WOODS

For Umbrella-Tragedy - you might have pictured an umbrella blown inside out.

For Multiplication-Apple - you might have mentally pictured an apple times an apple.

For Cleanness-Cost - you might have pictured a dollar sign being scrubbed clean.

For Tablespoon-Woods - you might have pictured a woods of tablespoons instead of trees.

Each slide will be shown for a limited period of time. After all the slides are shown, you will be given a list of the words which appeared first in each pair, like this. That is, using the examples again, you will receive a list of Umbrella, Multiplication, Cleanness and Tablespoon. You will be expected to supply the word that was shown on the slide with the word given. Beside umbrella you would write what? (pause) Tragedy. Beside multiplication_____? (pause) Apple; Cleanness_____? (pause) Cost, and beside tablespoon_____? (pause) Woods. In order to help yourself remember the word you are trying to recall, try to remember the mental picture you had when the two words were shown.

After you have completed the recall test, please turn your paper over and remain seated until the rest of the group is finished.

Are there any questions?

# APPENDIX D

## IMAGERY, SCAT AND RECALL TESTS SCORES ARRANGED BY IMAGERY ABILITY LEVEL HIGH TO LOW

| Subject | Imagery | SCAT Percentile | Treatment | Immediate Test CC | CA | AC | AA | Delayed Test CC | CA | AC | AA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 49 | 47 | V | 6 | 5 | 3 | 5 | 4 | 2 | 1 | 1 |
| 2 | 51 | 64 | P | 6 | 6 | 3 | 4 | 3 | 2 | 1 | 1 |
| 3 | 61 | 50 | P | 4 | 2 | 4 | 2 | 1 | 0 | 0 | 0 |
| 4 | 65 | 26 | V | 4 | 3 | 2 | 2 | 3 | 0 | 0 | 0 |
| 5 | 73 | 62 | P | 4 | 4 | 2 | 2 | 0 | 1 | 1 | 0 |
| 6 | 73 | 44 | V | 4 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| 7 | 77 | 44 | V | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 |
| 8 | 78 | 78 | P | 6 | 4 | 1 | 1 | 1 | 0 | 1 | 0 |
| 9 | 80 | 62 | V | 7 | 7 | 5 | 4 | 2 | 2 | 1 | 1 |
| 10 | 82 | 87 | P | 7 | 5 | 5 | 2 | 1 | 0 | 1 | 0 |
| 11 | 83 | 90 | P | 7 | 6 | 6 | 5 | 3 | 0 | 1 | 0 |
| 12 | 85 | 17 | P | 5 | 2 | 1 | 0 | 2 | 1 | 1 | 0 |
| 13 | 87 | 50 | V | 7 | 4 | 2 | 2 | 2 | 3 | 1 | 0 |
| 14 | 90 | 23 | V | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 91 | 44 | P | 6 | 6 | 1 | 3 | 0 | 0 | 0 | 0 |
| 16 | 93 | 60 | P | 7 | 5 | 3 | 1 | 1 | 0 | 0 | 0 |
| 17 | 93 | 28 | P | 5 | 5 | 4 | 3 | 0 | 0 | 1 | 0 |
| 18 | 95 | 57 | P | 4 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 19 | 95 | 40 | P | 7 | 4 | 5 | 5 | 3 | 2 | 2 | 0 |
| 20 | 96 | 96 | P | 7 | 6 | 5 | 6 | 3 | 0 | 1 | 3 |
| 21 | 97 | 86 | V | 7 | 5 | 4 | 5 | 3 | 1 | 2 | 1 |
| 22 | 97 | 66 | V | 6 | 7 | 3 | 4 | 3 | 1 | 1 | 0 |
| 23 | 97 | 62 | P | 5 | 3 | 3 | 0 | 4 | 2 | 3 | 1 |
| 24 | 99 | 62 | P | 7 | 6 | 6 | 6 | 0 | 1 | 0 | 0 |
| 25 | 100 | 28 | P | 7 | 5 | 5 | 3 | 1 | 2 | 1 | 1 |
| 26 | 101 | 71 | P | 7 | 6 | 7 | 5 | 2 | 0 | 1 | 3 |

| Subject | Imagery | SCAT Percentile | Treatment | Immediate Test | | | | Delayed Test | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CC | CA | AC | AA | CC | CA | AC | AA |
| 27 | 101 | 66 | P | 7 | 4 | 4 | 5 | 5 | 1 | 1 | 0 |
| 28 | 102 | 45 | V | 6 | 5 | 4 | 1 | 1 | 1 | 1 | 1 |
| 29 | 103 | 45 | P | 6 | 0 | 2 | 0 | 2 | 0 | 0 | 0 |
| 30 | 104 | 45 | P | 4 | 5 | 1 | 1 | 0 | 1 | 0 | 1 |
| 31 | 105 | 78 | V | 5 | 4 | 4 | 3 | 1 | 0 | 1 | 1 |
| 32 | 105 | 51 | P | 7 | 6 | 4 | 2 | 0 | 1 | 0 | 0 |
| 33 | 108 | 47 | P | 6 | 5 | 5 | 3 | 1 | 0 | 0 | 1 |
| 34 | 110 | 64 | V | 6 | 3 | 1 | 0 | 1 | 1 | 1 | 0 |
| 35 | 111 | 30 | V | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 36 | 113 | 40 | V | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |
| 37 | 113 | 6 | V | 3 | 4 | 4 | 2 | 0 | 0 | 0 | 0 |
| 38 | 115 | 16 | V | 5 | 4 | 3 | 2 | 0 | 0 | 0 | 0 |
| 39 | 116 | 17 | P | 4 | 4 | 2 | 3 | 1 | 1 | 0 | 1 |
| 40 | 119 | 84 | P | 6 | 5 | 5 | 2 | 2 | 0 | 0 | 0 |
| 41 | 119 | 40 | V | 4 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |
| 42 | 120 | 40 | P | 7 | 4 | 3 | 2 | 3 | 3 | 0 | 0 |
| 43 | 121 | 62 | V | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 |
| 44 | 121 | 47 | V | 7 | 5 | 3 | 4 | 1 | 0 | 0 | 0 |
| 45 | 125 | 50 | P | 6 | 6 | 5 | 5 | 0 | 0 | 0 | 0 |
| 46 | 126 | 40 | P | 5 | 6 | 2 | 3 | 1 | 2 | 1 | 0 |
| 47 | 127 | 40 | V | 7 | 5 | 4 | 7 | 1 | 0 | 0 | 0 |
| 48 | 128 | 80 | V | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 49 | 129 | 93 | P | 6 | 6 | 5 | 5 | 1 | 0 | 0 | 0 |
| 50 | 129 | 40 | V | 7 | 6 | 3 | 5 | 4 | 3 | 2 | 0 |
| 51 | 131 | 15 | P | 7 | 3 | 3 | 1 | 1 | 0 | 1 | 0 |
| 52 | 132 | 17 | P | 7 | 3 | 0 | 1 | 0 | 1 | 0 | 0 |
| 53 | 136 | 51 | V | 5 | 6 | 6 | 4 | 1 | 2 | 1 | 1 |
| 54 | 137 | 28 | P | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 55 | 138 | 35 | P | 6 | 4 | 4 | 3 | 2 | 0 | 1 | 0 |
| 56 | 139 | 38 | V | 5 | 1 | 1 | 1 | 2 | 0 | 0 | 0 |

| Subject | Imagery | SCAT Percentile | Treatment | Immediate Test | | | | Delayed Test | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CC | CA | AC | AA | CC | CA | AC | AA |
| 57 | 140 | 60 | P | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 58 | 141 | 66 | V | 7 | 5 | 5 | 6 | 0 | 0 | 1 | 0 |
| 59 | 142 | 70 | P | 6 | 4 | 3 | 4 | 0 | 1 | 1 | 0 |
| 60 | 142 | 48 | V | 7 | 3 | 4 | 2 | 4 | 0 | 1 | 0 |
| 61 | 142 | 40 | V | 7 | 7 | 3 | 7 | 4 | 2 | 1 | 2 |
| 62 | 145 | 73 | P | 5 | 5 | 6 | 3 | 2 | 1 | 1 | 0 |
| 63 | 145 | 53 | P | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| 64 | 146 | 62 | P | 7 | 6 | 6 | 4 | 0 | 0 | 1 | 0 |
| 65 | 146 | 40 | P | 7 | 6 | 2 | 2 | 0 | 1 | 0 | 0 |
| 66 | 147 | 62 | V | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 67 | 147 | 40 | V | 6 | 6 | 3 | 5 | 2 | 1 | 0 | 0 |
| 68 | 147 | 40 | P | 6 | 7 | 5 | 4 | 1 | 0 | 1 | 0 |
| 69 | 148 | 78 | P | 5 | 4 | 4 | 4 | 0 | 1 | 0 | 0 |
| 70 | 148 | 20 | V | 7 | 6 | 4 | 6 | 6 | 5 | 2 | 2 |
| 71 | 149 | 22 | V | 6 | 4 | 1 | 1 | 1 | 0 | 0 | 0 |
| 72 | 149 | 20 | P | 7 | 7 | 5 | 6 | 3 | 0 | 1 | 1 |
| 73 | 151 | 60 | V | 6 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |
| 74 | 154 | 73 | V | 7 | 5 | 4 | 4 | 2 | 0 | 1 | 1 |
| 75 | 154 | 49 | P | 6 | 2 | 2 | 2 | 0 | 1 | 0 | 1 |
| 76 | 155 | 28 | P | 6 | 5 | 2 | 4 | 2 | 0 | 0 | 0 |
| 77 | 155 | 23 | V | 7 | 4 | 4 | 6 | 0 | 0 | 0 | 0 |
| 78 | 157 | 50 | V | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 79 | 159 | 62 | P | 6 | 6 | 4 | 3 | 3 | 2 | 2 | 0 |
| 80 | 159 | 50 | V | 7 | 4 | 1 | 0 | 3 | 0 | 0 | 0 |
| 81 | 163 | 66 | P | 6 | 5 | 4 | 3 | 0 | 0 | 0 | 0 |
| 82 | 164 | 94 | V | 7 | 5 | 3 | 4 | 0 | 0 | 1 | 0 |
| 83 | 167 | 93 | P | 6 | 6 | 5 | 6 | 1 | 1 | 1 | 1 |
| 84 | 167 | 18 | V | 5 | 4 | 1 | 1 | 2 | 1 | 1 | 0 |
| 85 | 168 | 62 | P | 5 | 4 | 3 | 5 | 2 | 0 | 1 | 0 |
| 86 | 169 | 85 | P | 6 | 5 | 5 | 6 | 1 | 1 | 1 | 0 |

| Subject | Imagery | SCAT Percentile | Treatment | Immediate Test | | | | Delayed Test | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CC | CA | AC | AA | CC | CA | AC | AA |
| 87 | 170 | 22 | P | 7 | 6 | 6 | 4 | 0 | 0 | 0 | 0 |
| 88 | 171 | 22 | V | 7 | 4 | 3 | 3 | 2 | 0 | 1 | 0 |
| 89 | 180 | 31 | V | 7 | 7 | 6 | 5 | 2 | 0 | 0 | 0 |
| 90 | 186 | 60 | P | 6 | 1 | 1 | 1 | 2 | 0 | 1 | 0 |
| 91 | 186 | 7 | V | 7 | 1 | 2 | 2 | 0 | 0 | 1 | 0 |
| 92 | 193 | 52 | P | 7 | 6 | 3 | 1 | 1 | 0 | 1 | 0 |
| 93 | 197 | 98 | P | 5 | 7 | 6 | 5 | 3 | 1 | 2 | 0 |
| 94 | 197 | 51 | P | 5 | 2 | 3 | 2 | 0 | 0 | 1 | 0 |
| 95 | 199 | 58 | V | 4 | 2 | 3 | 1 | 0 | 0 | 0 | 0 |
| 96 | 200 | 29 | P | 3 | 2 | 0 | 1 | 1 | 0 | 0 | 0 |
| 97 | 201 | 1 | V | 4 | 4 | 1 | 1 | 1 | 0 | 1 | 0 |
| 98 | 204 | 73 | P | 7 | 5 | 6 | 4 | 1 | 0 | 0 | 0 |
| 99 | 206 | 78 | P | 7 | 5 | 5 | 3 | 2 | 0 | 2 | 0 |
| 100 | 209 | 66 | V | 3 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| 101 | 229 | 31 | P | 7 | 5 | 6 | 4 | 2 | 1 | 0 | 0 |
| 102 | 232 | 85 | V | 6 | 5 | 3 | 5 | 6 | 3 | 2 | 3 |
| 103 | 244 | 47 | V | 5 | 5 | 1 | 4 | 2 | 0 | 0 | 0 |

# APPENDIX E

# IMMEDIATE RECALL TEST

SS #_____

NAME_____

1. Butter _____
2. Duty _____
3. Diamond _____
4. Wheat _____
5. Economy _____
6. Dress _____
7. Trouble _____
8. Meat _____
9. Safety _____
10. Coin _____
11. Idea _____
12. Pleasure _____
13. Capacity _____
14. Bottle _____
15. Justice _____
16. Life _____
17. Quality _____
18. String _____
19. Sugar _____
20. Theory _____
21. Pole _____
22. Virtue _____
23. Love _____
24. Shoes _____
25. Chaos _____
26. Bowl _____
27. Nail _____
28. Ship _____

# APPENDIX F

# DELAYED RECALL TEST

Social Security No._____

Name_____

1. Bottle _____
2. Nail _____
3. Safety _____
4. Chaos _____
5. Justice _____
6. String _____
7. Coin _____
8. Shoes _____
9. Ship _____
10. Wheat _____
11. Butter _____
12. Pleasure _____
13. Duty _____
14. Theory _____
15. Idea _____
16. Virtue _____
17. Life _____
18. Capacity _____
19. Dress _____
20. Bowl _____
21. Trouble _____
22. Sugar _____
23. Diamond _____
24. Pole _____
25. Love _____
26. Quality _____
27. Meat _____
28. Economy _____

**The two page vita has been removed from the scanned document. Page 1 of 2**

**The two page vita has been removed from the scanned document. Page 2 of 2**

MENTAL IMAGERY AND LEARNING IN A COMMUNITY COLLEGE:
A STUDY TO DETERMINE IF THE ABILITY TO IMAGE MENTALLY
AFFECTS LEARNING FROM PICTORIAL OR VERBAL PRESENTATIONS

by

Patricia Ann Hunter

(ABSTRACT)

This was a study to determine the effects of varying imaging abilities and differing formats of slide programs (pictorial and verbal) in promoting recall of paired-associates presented to community college students (N = 103) in introductory psychology classes.

The students were divided into High and Low Imagers on the basis of their scores on the shortened Betts' Questionnaire upon Mental Imagery. To control for the effect of intelligence on learning, students within each imagery group were ranked according to their School and College Ability Test (SCAT) verbal aptitude score. Within each imagery group, subjects with the highest SCAT score were randomly assigned to each treatment group. The next two highest scores were then assigned. After all students were assigned to a group, the treatment, pictorial or verbal, was randomly assigned.

The paired-associate categories in each presentation were concrete-concrete, concrete-abstract, abstract-concrete and abstract-abstract.

The slides in both presentations were shown for 7 seconds each. The pictorial presentation was a series of 28 slides of the paired-associates and an interactive cartoon drawing of the items named. The

verbal presentation was a series of 28 slides of the paired-associates only, with the students being instructed to image mentally the items named in an interacting situation. The same paired-associates were used in each presentation.

The presentations were followed by an immediate recall test and, two weeks later, by a delayed recall test. Both tests listed the 28 words shown first on each slide. The students were to write the word which had appeared with the word given. The students were directed to image mentally to facilitate recall.

Results of the Multivariate Analysis of Covariance (on SCAT) on the immediate recall test scores indicated no significant difference in recall due to imagery ability, type of presentation or interaction between them. Results of the Univariate Analyses of Covariance (on SCAT) with repeated measures on each of the four categories of paired-associates indicated significant differences due to time of testing (immediate and two-week delayed) in all categories; significant interaction of imagery ability and treatment in the concrete-concrete category; and in the concrete-abstract and abstract-concrete categories, significant interactions between treatment and time of testing.

There was no correlation between imagery ability and academic aptitude.