To the Graduate Council:

I am submitting herewith a dissertation written by Clarence Edwin Cherry, Jr. entitled "The Measurement of Adult Learning Styles: Perceptual Modality." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Curriculum and Instruction.

Russell L. French

Russell L. French, Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

L Evan Rob

Vice Chancellor
Graduate Studies and Research

THE MEASUREMENT OF ADULT LEARNING STYLES: PERCEPTUAL MODALITY

A Dissertation

Presented for the

Doctor of Education

Degree

The University of Tennessee, Knoxville

Clarence Edwin Cherry, Jr.

August 1981

DEDICATION

This work is dedicated to the memory of

Dollie Mae Crow Cherry

April 14, 1911

March 22, 1981

Her influence made this work and all worthwhile works of my life possible. She cared for and influenced me as a child; for this project she made the blindfolds, handled the mail, and generally encouraged me to succeed. She always gave of herself to help others - especially me. Momma is truly missed by one and all - especially me.

ACKNOWLEDGEMENTS

Time, space, and words are not available to adequately express this writer's sincere appreciation to all those who assisted and encouraged the writer in completing this project. Countless individuals provided more support than anyone could ever repay; each of them is truly appreciated.

For their professional guidance, suggestions, and direction, sincere gratitude is extended to the members of this writer's Doctoral Committee: Dr. Russell L. French, Dr. R. Lewis Hodge, Dr. John M. Peters, and Dr. Francis M. Trusty. Each of them has provided counsel and sound direction for this writer's professional growth. Special appreciation is extended Dr. Russell L. French, Committee Chairman, for the countless hours of patient counsel and wise advice given to this writer in this project and throughout the doctoral studies.

Finally, for more than ten years Lyn, David, and John have done without the full attention of their husband and father; for this project, they were required to go the proverbial extra mile, and they did. Their patience, understanding, encouragement, and actual participation can never be repaid; it can, however, be said that their husband and father loves and appreciates each of them very much.

ABSTRACT

This study focused on the measurement of individual perception learning styles. The seven styles under investigation were originally conceptualized by Dr. Russell L. French[1] in 1975; six of those styles were first measured by Dr. Daryl V. Gilley[2] in the same year. The seven measured styles were: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. Two individual subject styles measurement systems were used in the study. One was a revision of Gilley's Multi-Modal Paired Associates Learning Test (MMPALT); the other was the Perceptual Modality Preference Survey (PMPS) which was developed specifically for this study.

While Gilley's research was conducted with third grade students, subjects in this study were adult volunteers. They varied in age, education, and geographic background. Represented were 31 different states, an age range of 19 through 68 years, and a formal education range of eighth grade to advanced degrees. The population included 76 males and 20 females. Volunteers were used because adult learners are

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[1]Russell L. French, Teaching Style and Instructional Strategy. Unpublished paper, Department of Curriculum and Instruction, The University of Tennesse, Knoxville, 1975.

[2]Daryl V. Gilley, Personal Learning Styles Exploring the Individual's Sensory Input Processes. Ed.D. Dissertation, The University of Tennessee, Knoxville, August, 1975.

generally self-directed and self-motivated towards learning and because the focus of investigation was the measurement of learning style within individuals rather than adults in general.

The revised MMPALT was used to identify the dominance pattern of the seven perceptual styles in each subject. The PMPS was used to measure the pattern of each subject's personal preferences among styles. In both assessments, patterns for the entire subject population were determined by simple summations of individual subject data. Patterns within various recognizable sub-groups were also established using the summative approach. Because of the nature of the subject population, the group and sub-group derived conclusions are not generalizable to other adult learner populations. The study did, however, produce the following findings:

1. The seven perceptual styles conceptualized by French did exist as perceptual learning styles in this adult population.

2. There were measurable variations in perceptual learning styles of individual adult learners in this study.

3. Overall, the most dominant perceptual style found empirically in these adults was the visual; the second most dominant style was the haptic.

4. Patterns found in these adult subjects were comparable to those found by Gilley in third grade children; however, variations apparently influenced by differences in age, experience, maturity, and education did appear.

5. Correlations between subject self-reports (preference data) and empirical test data were low to slight.

6. Correlations between self-report data and empirical test data increased with subjects' years of formal education and knowledge of learning style concepts.

TABLE OF CONTENTS

CHAPTER PAGE

LIST OF TABLES

CHAPTER I

INTRODUCTION

Four out of five Americans are involved in the learning programs of the nation. Adult learners are entering and re-entering the various programs from all educational backgrounds and all social, economic, and occupational levels. Penland has reported that these adult learners have individualistic learning patterns, and they prefer to control the pace and character of their own learning (Penland, 1978). The challenge to educators and administrators in adult programs is to provide the help that adult learners need to plan, conduct, and control their own learning experiences. To this end, adult educators need skills and tools for the identification of the individual differences in adult learners.

Various models have been developed to identify and measure individual differences, but there is a lack of agreement among the approaches. Those having their foundations in psychology tend to focus on internal or neural processes (Martens, 1975); those having their roots in classroom processes tend to focus on the learning environment and the students' interactions to stimuli (Oen, 1973). Both approaches to the study of individual differences have resulted in a concern for learning style as one basic area of differences among learners.

Psychologically based attempts at identifying and measuring individual learner differences have focused on the development of behavioral laws of learning. These studies have produced such learning concepts as field dependence-independence, impulsive-reflective, and leveling-sharpening, even though Glaser has said:

> The widespread inattention to individual differences seems to indicate that psychologists have been uniquely optimistic in their expectations for the generality of behavioral laws. (Glaser, 1965.)

To predict the future of learning, the specific strengths and weaknesses of each learner must be identified. Gagne and Glaser have referred to these strengths and weaknesses as the specific limiting conditions of the learner; Glaser said, ". . . we need to be more active in postulating initial properties of the learner which interact with learning." (Gagné, 1967.)

Practicing educators have focused their attention on classroom environment and activities. Areas of classroom stimuli study have included emotional elements of motivation and persistence; environmental elements of sound and light; sociological elements of self, pairs, and teams; and physical elements of time, intake, and perception (Dunn and Dunn, 1978). Hill divided the perceptual or sensory stimuli category into five elements: auditory, olfactory, savory, tactile, and visual (Hill, 1976). Individual student measurements of these elements are taken with self-report or teacher-assessment opinion surveys, and classroom teaching practices are

adjusted to the survey results. The survey or self-assessment approach to learning style assessment has not been scientifically validated.

Both practical educators and psychological researchers have expressed concerns for individual differences in perception. For example, French (1975) conceptualized seven perceptual learning styles: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. Those seven are referred to as perceptual modality elements of individual learning style, and they serve as the foundation for this study's examination of measurement techniques.

I. THE PROBLEM

In her 1977 dissertation, Scarbrough concluded, "Investigation into learning styles preference has been hampered by the lack of appropriate instruments."

Other authors have identified at least three major problems with instruments and procedures used to measure the strengths and weaknesses of individual learning styles. The more subjective systems appear to lack validity (London, 1976; Sailor, 1978; Sheriff, 1978); the more objective systems are narrow in scope, time consuming, and complex; and each system is generally applied to a narrow population of age and background.

Using French's (1975) conceptualization of learning styles, Gilley (1975) developed and tested an objective

system for measuring individual differences in perceptual learning style. His "Multi-Modal Paired Associates Learning Test (MMPALT)" was used to measure six of French's perceptual modality elements. Gilley confirmed the validity of his instrument and concluded that his subjects (third grade students), ". . . do receive and process information with different degrees of efficiency across the six sensory modalities." Gilley's recommendations for additional research served as guidelines for this study's examination of measurement procedures. The Gilley recommendations included:

> An attempt should be made to replicate this study including a larger sample with subjects of different age groups, socioeconomic, ethnic, and geographic backgrounds.
>
> Similar studies should be completed with subjects at various levels of development.
>
> Investigations into other theoretical style elements should be initiated.
>
> Efforts should be made to develop efficient methods of diagnosing personal learning styles.

II. PURPOSE OF THE STUDY

This study addressed three specific needs in the measurement of individual learning styles. First, the Gilley system of perceptual style measurement was extended to an adult population. This was done to examine the existence of the same style elements across different groups and further validate the Gilley system. Second, one of French's original elements (olfactory), not examined by Gilley, was

added to the measurement system. This was done to expand and further validate the Gilley system. Third and primarily, the findings from the expanded Gilley measurement system were compared to the findings from a survey or self-report system designed to measure the same perceptual modality elements of individual learning style. This comparison was made to examine the validity of the self-report or survey approach to learning style assessment. Five specific questions posed in this investigation were:

1. Do the seven perceptual styles identified by French manifest themselves in adults?

2. Are there measurable variations in the perceptual learning styles of adults?

3. Are there dominant identifiable patterns of perceptual style within/across various groups of adult learners?

4. How do the measurements of perceptual styles in adults compare/contrast with the measurements conducted earlier by Gilley in children?

5. Do adult learner self-assessments of their perceptual modalities of learning style show positive correlation with empirical measurements of the same styles?

III. SIGNIFICANCE OF THE STUDY

Traditional education programs tend to group students and conduct classes in more or less the same manner for all learners, but learning is an individual activity and requires

some level of individualized instruction. The individualization of instruction is dependent on a knowledge of individual differences in each student. Numerous researchers have concluded that studying learning styles increases individualization, educational effectiveness, and educational efficiency. Relating individual differences to perception and learning disabilities, Wepman (1974) said:

> The ignoring of individual differences in the development of perceptual adequacy is seen to be responsible for many learning disabilities.

Gagné (1968) said, "Learning is an individual matter," and Scarbrough (1976) concluded, "Any grouping practice should consider the learning styles of the individuals involved." All of this can be summarized with a statement from Ingram's (1974) findings:

> The theory of learning styles measurement and the teaching to measured learning styles is a valid theory.

This study examined measurement procedures, further validated perceptual modality styles elements, identified general patterns of perceptual style within an adult population, and examined similarities and differences among various sub-groupings of that population. This new information can be added to the existing although primitive knowledge about individual differences to create a more solid research foundation, expand the general awareness of individual learning differences, and generally improve teaching and learning.

IV. PROCEDURES OF THE STUDY

Selection of Subjects

The primary goal of subject selection was to obtain a study population consisting of adult learners with a variety of educational and geographic backgrounds. Potential subjects were, therefore, solicited from a variety of sources. Letters of invitation (Appendix A) were distributed or mailed to participants of four programs: The Aluminum Company of America (ALCOA) apprenticeship program at Alcoa, Tennessee; The Adult Basic Education (ABE) program for Blount County, Tennessee; The counseling and rehabilitation program for state inmates housed at the Blount County Jail, Maryville, Tennessee; and three leadership development programs offered at the I. G. Brown Air National Guard (ANG) Professional Military Education Center (PMEC) located at McGhee Tyson ANG Base, Knoxville, Tennessee. Verbal invitations were also extended to educational colleagues of this researcher. Approximately 700 individuals received either written or verbal invitations to have their perceptual learning styles measured.

Ninety-six adults responded to the invitations and participated in the measurement project. The total subject group consisted of 76 males and 20 females. They averaged 34 years of age and 13.6 years of formal education. The volunteer subjects came from 31 different states and were participants in a variety of educational programs.

Instrumentation

Each subject participated in two measurements of his or her perceptual modality learning style. The two instruments used in this study were the revised Multi-Modal Paired Associates Learning Test, hereafter identified as revised MMPALT, and the Perceptual Modality Preference Survey (PMPS).

Revised MMPALT. This instrument identifies the relative strengths of each of the seven elements of perceptual style in the testee: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. (Appendix C.) The test consists of 10 pairs of stimulus and response members for each element. The subject is presented with all 10 pairs of stimulus and response members in a particular element. Then he or she is presented with only the stimulus member of each associated pair in a different order from that used in the initial presentation and asked to recall the correct response member. In the original MMPALT, Gilley used five pairs and a trials-to-mastery scoring system. The revised MMPALT employs 10 pairs and is scored on the number of correct responses. This modification was suggested by Gilley, and it is consistent with guidelines from other paired associates tests (Jensen, 1967). The seven scores (one for each element tested) for each subject are arranged from high to low to produce a rank ordering of the elements of the subject's perceptual learning style.

Further revision of the original MMPALT included:

1. Changes in some of the stimulus and response materials, because the original materials were no longer available.

2. Development of stimulus and response materials for the olfactory style element which Gilley had not measured.

3. Pairings and presentation sequences were randomized or re-randomized as necessary to assure objectivity.

Perceptual Modality Preference Survey (PMPS). The objective of this survey, developed by the investigator, was to secure each subject's intuitive assessment of his or her own strengths and weaknesses in each of the seven perceptual learning styles. The forced choice questionnaire contains 42 response items. Each perceptual style element is contrasted with each of the other style elements twice and in reverse order. A subject responds to each statement by choosing one of four alternatives: Always, Usually, Seldom, or Never. To counteract any conflicting responses and evaluate both style elements in each statement, responses are scored with positive (accepting the statement) and negative (rejecting the statement) values. (See Figure 1.)

The scores for the various style elements are then arranged from high to low to produce a strongest (preferred) to weakest rank ordering of the subject's subjective assessment of his or her own learning style. This procedure is based on the Likert method of summated ratings as reported by Best (1959) and others. (Appendix D.)

Directions:

For an "Always" response, score +4 for the first (accepted) element contained in the statement, and score -2 for the final (rejected) element in the statement.

For a "Usually" response, score +2 for the first (partially accepted) element listed in the statement, and score -1 for the final (partially rejected) element in the statement.

For a "Seldom: response, score -2 for the first (partially rejected) element listed in the statement, and score +1 for the final (partially accepted) element in the statement.

For a "Never" response, score -4 for the first (rejected) element listed in the statement, and score +2 for the final (accepted) element in the statement.

Sample Statements:

Number 1: I learn better by reading than by listening.

Number 28: I learn better by listening than by reading.

Sample Responses:

Number 1: Always (X) Usually ( ) Seldom ( ) Never ( )

Number 28: Always ( ) Usually ( ) Seldom (X) Never ( )

Sample Scoring:

	Print	Aural	Interactive	Visual	Haptic	...
Number 1:	+4	-2	0	0	0	...
Number 28:	+1	-2	0	0	0	...
Total	+5	-4	0	0	0	...

Figure 1. Explanation and Demonstration of PMPS Scoring System

Methodology

For participation in the styles measurement process, each subject was scheduled through three stations. At Station A, the subjects received an introduction to the concept of learning styles and an explanation/demonstration of the testing procedures. At Station B, the subjects completed four individually conducted evaluation processes. The four revised MMPALT elements measured at Station B were: interactive, haptic, kinesthetic, and olfactory. At Station C, the subjects completed three group conducted measurement processes and the PMPS questionnaire. The revised MMPALT elements measured at Station C were: print, aural, and visual. After all testing and the questionnaire were completed, the subjects were given an opportunity to examine their initial test results and discuss those results. (Appendix B.)

To eliminate first-test, second-test interaction bias in any group results, half of the subjects completed the PMPS as their first activity, and half completed the PMPS as their last activity.

Collection and Treatment of Data

Optical scan forms were used as answer sheets for the PMPS, and demographic data also were collected on that form. Data on the form included the subject's identification number, age, years of formal education (up to 16), sex, and revised MMPALT scores. All data were processed in The University of

Tennessee Computing Center. The computer products included data for each individual subject and computations of data for the various groupings of subjects.

Individual Data. Data analyzed and reported for each subject included rank orderings of perceptual style elements obtained on both instruments and a correlation of the two sets of scores using Spearman's rank order correlation coefficient applied to the two rankings. The Spearman's correlation formula included a correction for ties. The general criterion for evaluation of significance, reported by Best (1959), was used to categorize the correlation coefficients:

Correlation:	Relationship:
00 to ± .20	Negligible
±.20 to ± .40	Low or Slight
±.40 to ± .60	Moderate
±.60 to ± .80	Substantial or Marked
±.80 to ±1.00	High to Very High

Specific attention also was given to the first and second highest ranked styles for each subject on each measurement. (Appendix G.)

Group Data. Data from 23 subject groupings received specific treatment. The revised MMPALT and the PMPS scores were totaled and ranked for each of the groups. Analysis of group data employed the same procedures as those applied to individual data. Subject groupings included: the total subject population (96), subjects completing the PMPS first

(43), subjects completing the PMPS last (43), males (76), females (20), ABE (9), jail (7), PMEC (60), NCOA (34), AMS (20), LS (6), test (10), colleagues (19), under 12 years education (11), 12 years education (22), some college (38), 16 or more years of education (25), 19-24 years of age (16), 25-29 years of age (22), 30-34 years of age (11), 35-39 years of age (21), 40-44 years of age (15), and 45-68 years of age (11). Again specific attention was given to the first and second highest styles in each group on each instrument. (Appendix F.)

V. LIMITATIONS OF THE STUDY

1. The population sampled was restricted to approximately 700 adult learners who received either verbal or written invitations to have their learning styles measured.

2. The study population was limited to 96 adults who volunteered to have their perceptual learning styles measured; therefore this study's group findings are not generalizable to other populations.

3. All measurements were conducted between September 1, 1980 and November 15, 1980.

4. Although precautions were taken to balance the level of difficulty across the seven elements of the revised MMPALT, that balance was not assured.

5. The original MMPALT and the revised MMPALT use a paired associates testing procedure. That procedure, which measures one's ability to remember and/or discriminate among

information presented within a particular framework, may not measure all factors which make up one's perceptual learning style.

6. Although precautions were used in the construction, administration, and scoring of the Perceptual Modality Preference Survey (PMPS), the validity of that instrument has not been statistically established.

7. Not all measurements were conducted in the same physical location. Although care was taken to create similar physical settings, environmental differences could have influenced test results.

8. A number of subjects in the study were participants (students) in academic programs of the Air National Guard. Although there was little or no evidence that they volunteered to participate in the study because of the researcher's tie to those programs, this relationship could have influenced some test results.

VI. ASSUMPTIONS OF THE STUDY

Several procedural factors and pertinent considerations should be mentioned before starting the assumptions underlying this study:

1. Gilley developed, tested, and validated the original Multi-Modal Paired Associates Learning Test (MMPALT). After consultation with Gilley and French, the MMPALT was revised for this research. All modifications were consistent

with Paired-Associates learning theory and based on Gilley's recommendations.

2. Construction of the Perceptual Modality Preference Survey (PMPS) was supervised by experts in the field of questionnaire development.

3. Adult learners generally enter educational programs on a volunteer basis, and they are generally motivated towards self-discovery and self-development.

Assumptions basic to this study included the following:

1. Self-awareness and instructor awareness of student learning styles will influence the teaching-learning process.

2. The revised MMPALT is a valid system for objectively measuring individual differences in the perceptual modality elements of learning style.

3. Responses to the PMPS reflect each subject's subjective opinion of his or her own perceptual modality learning style.

4. This study focused on measurements of the individual learning styles of self-directed adults not groups; therefore, the use of volunteer subjects does not distort or damage the findings.

VII. DEFINITION OF TERMS

Adult. A person over 18 years of age.

Learner. A person engaged in or expressing an interest in the acquisition of new skills or knowledge.

Learning Style. Individual differences in relating to or interacting with the environment for the purpose of learning.

Perceptual Modality of Learning Style. The approach which an individual learner uses in gathering information and knowledge from the world about him or her through the five senses. In this study, the seven perceptual style elements identified by French and researched by Gilley were the basis for investigation. These seven perceptual style elements are:

Print (P). Gathering information primarily through the printed word.

Aural (A). Gathering information primarily through listening.

Interactive (I). Gathering information primarily through discussion and talking with others.

Visual (V). Gathering information primarily through seeing pictures, images, objects, and activities.

Haptic (H). Gathering information primarily through touching and/or holding.

Kinesthetic (K). Gathering information primarily through performance or engaging in body movements.

Olfactory (O). Gathering information primarily through the sense of smell.

Revised Multi-Modal Paired Associates Learning Test (revised MMPALT). A seven-set paired associates learning

test designed to rank order the perceptual modality strengths and weaknesses of each subject through objective measurement.

Perceptual Modality Preference Survey (PMPS). A 42 item questionnaire designed to survey each subject's intuitive perception of his or her perceptual learning style, and report those styles in rank order.

Achievement. For purposes of this study, achievement is broadly defined to include experience, degree of self-direction and self-discipline, and general level of maturity.

VIII. ORGANIZATION OF THE STUDY

Chapter I has identified the problem under investigation, stated the purpose of the study, discussed the importance of the study, outlined the procedures of the study, identified the limitations and assumptions of the study, and defined special terms used in the study.

Chapter II presents a review of related literature including sections on individual differences and learning, modalities and elements of learning styles, and measurement of individual differences.

Chapter III details procedures used in this study. It includes sections on revision of the MMPALT, construction of the PMPS, subject selection, evaluator training, test administration, and data analysis.

Chapter IV presents the findings of the study with reference to both individuals and groups.

Chapter V summarizes findings of the investigation, presents and discusses conclusions, and develops recommendations.

CHAPTER II

REVIEW OF LITERATURE

I. INTRODUCTION

Much research in the area of personal learning style has come from the field of psychology. Psychological research tends to focus on the human organism's internal reactions to stimuli and the organism's external reactive behavior. It is the contention of this researcher as well as others (French, 1981), that human learners are purposeful actors in the world of learning, not simply reactors. Research with this focus is limited. Psychological focus notwithstanding, some authorities have addressed this issue. In reporting the Personal Construct Theory of Professor George A. Kelly, Goldstein said:

> For Kelly, man was not simply a stimulus-response organism who reacted automatically to environmental stimuli. Rejecting the implied human quiescence of this model, in which man's natural state is one of inactivity until goaded by a stimulus, Kelly argued that man is actively involved in cognitively organizing the world around him; the essence of man's activity is his forecasting of events. The individual makes predictions about what will occur and modifies his ideas based on the outcome of these predictions. Kelly termed these ideas constructs. A basic notion of Kelly's formulation is that man is capable of representing the environment, not merely responding to it, and that differing representations lead to different behaviors. (Goldstein, 1978, p. 104.)

When purposefully acting for the purpose of learning, each individual student must deal with the flow of information.

Starting from a basis of computer information processing, James L. McKenney presented a model for human information processing and related that model to the study of individual differences. McKenney believes that individuals develop both conscious strategies and unconscious habits for taking-in information. When discussing his model, McKenney said:

> Human information processing is composed of two general modes of behavior: First, communicating with the environment to obtain data and to return data to other people. Second, organizing data received to bring relevant experience to bear to make useful predictions. Man's information processing is essentially a cognitive process of communicating with the world and manipulating information that comes to him. (Martens, 1975, p. 5.)

Be they conscious strategies or unconscious habits, it is apparent that human learners have individual differences in reaching out for new information.

The individual differences in information acquisition signal the need for individualized instruction, and educators in virtually every field recognize that need and its relationship to the measurement of learning styles. From the field of vocational education, Bjorkquist (1971) said:

> Teachers are increasingly becoming managers of the learning process rather than dispensers of knowledge and are being challenged to individualize their instruction to account for variability.

From the field of second-language education, Eliuk-Nakonechny (1976) said:

> Individualized learning is one of the current educational trends. This approach is an answer to the differences found among students in terms of their abilities and disabilities, learning styles, objectives and interests.

From the community college setting, Griffin (1974) said:

> If a community college is truly committed to the idea of individualized learning, it must make a concerted effort to discern the learning style preference of each student.

To address these expressed needs, this review will examine individual differences and learning, the modalities and elements of learning style, the measurement of learning styles, and research findings.

II. INDIVIDUAL DIFFERENCES AND LEARNING

Early research and theory gave minimum consideration to differences in individual learners. In his 1965 book, The Conditions of Learning, Gagné seemed to view learning as a simple relationship between stimulus and response. He wrote, ". . . there is an unvarying relationship between stimulus and response. The learning change is from:

Stimulus ——→ (nothing)

to

Stimulus ——→ Response." (p. 8.)

Additionally, Gagné viewed all animals, including the human animal, as near equals in learning style. In discussing the elements in a learning situation, he said:

> First there is a learner, who is a human being. (It would be possible for the learner to be an animal, but that is another story.) For the events considered here the most important parts of the learner are his senses, his central nervous system, and his muscles. Events in his environment affect the learner's senses, and start chains of nervous impulses that are organized by his central nervous system, specifically, his brain. This nervous activity occurs in certain

> sequences and patterns that alter the nature of the organizing process itself, and this effect is exhibited as learning. Finally, the nervous activity is translated into action that may be observed as the movement of muscles in executing responses of various sorts. (Gagné, 1965, p. 6.)

These generalizations about learners have lead to generalizations about teaching. It has been suggested that teaching should progress from the simple to the complex because:

> The individual learns simple things first, then more and more complex things; while all this is happening, he is also growing older. (Gagné, 1965, p. 175.)

The generalized theories of learning were challenged as early as 1939 by Lowenfeld. He theorized that differences in perception and reaction caused individuals to exhibit two distinct creativity types. Lowenfeld's studies caused him to believe that "the distinction which is true for creative types can also be made among individuals." (Lowenfeld, 1945, p. 100.) He specifically rejected the theory that perception is the same for all learners (Ragan, et al., 1979).

The 1965 quotation from Gagnè may misrepresent his views and the views of others at that time. In 1967, Gagné edited Learning and Individual Differences, and several times, including 1968, he specifically said, "Learning is an individual matter." By 1970, Gagné was seriously questioning earlier learning theories. In a discussion of the status of learning research, he said:

> As a field of endeavor, research on how human beings learn and remember is in a state of great ferment today. Many changes have taken place, and are still taking place, in the conception of what human learning is

> and how it occurs. Perhaps the most general description that can be made of these changes is that investigators are shifting from what may be called a connectionist view of learning to an information processing view. From an older view which held that learning is a matter of establishing connections between stimuli and responses, we are moving rapidly to acceptance of a view that stimuli are processed in quite a number of different ways by the human central nervous system, and that understanding learning is a matter of figuring out how these various processes operate. (Gagné, 1970, p. 468.)

The primary thrust of that 1970 Phi Delta Kappan article was the relationship of these new views to instruction. Gagné's concluding sentences clearly summarize the need to consider individual differences and to individualize instructional processes:

> In the most general sense, instruction becomes not primarily a matter of communicating something that is to be stored. Instead, it is a matter of stimulating the use of capabilities the learner already has at his disposal, and of making sure he has the requisite capabilities for the present learning task, as well as for many more to come. (Gagné, 1970, p. 472.)

As previously quoted, Gagné views the most important parts of the learner to be his or her senses, central nervous system, and muscles. It can be concluded, therefore, that both Gagné and Lowenfeld consider the senses to be an important aspect of individual differences and individual learning.

The study of the human senses, as related to learning, is in the domain of perceptual psychology. At one time, scholars made distinctions between sensation and perception, but perception is now accepted to include sensation:

> Early psychologists in the nineteenth century used to make distinctions between what they called "sensation" on the one hand and "perception" on the other. "Sensation" was thought of as some locally and

> specifically determined procedure in the receptive system of the organism, whereas "perception" referred to what was centrally picked up from the "sensory materials." The opinion of the irrelevance of this distinction is nowadays shared by most psychologists. Here the term "perception" will be preferred, despite its ambiguity. Such a term probably makes it easier to consider the alternatives of "objective" or "subjective," or better of "external" and "internal" determinants of our experienced life space. (von Fieandt, 1977, p. 8.)

This internal/external division of perception encourages this study's focus on each learner as a purposeful actor in the acquisition of knowledge.

Lowenfeld noted this same distinction in 1939. Through simple observations of partially blind art students, he discovered that some would use their limited sight and others would not. Lowenfeld, therefore, theorized that some individuals were visually oriented, and others were haptically oriented. Later research (e.g., 1957 and 1970) tended to verify his theory (Ragan, et al., 1979).

Individual differences, learning, and the thrust of this study are well summarized by Forgus in his 1966 textbook, Perception. Forgus clearly separates the human learner from lower animals, and he, just as clearly, identifies perception or extraction of information from the environment as the major difference between learners. Forgus said:

> I have decided to place the process of perception within the context of man's general need to adapt to to his environment if he is to cope effectively with the demands of life.
>
> DEFINITION OF PERCEPTION. In this quest for adaptive behavior the way the individual gains knowledge about his environment is of primary importance.

> The gaining of such knowledge necessitates the extraction of information from the vast array of physical energy which stimulates the organism's senses. Only those stimuli which have cue value, i.e., which trigger some kind of reactive or adaptive action from the individual, should logically be called information. For our purposes, perception will be defined as the process of information extraction.
>
> When we compare the higher mammals and especially man with the lower animals, we are tremendously impressed with the fact that the adaptive perceptual processes of the latter are largely completed through genetic evolution. That is to say, their perceptual programs are built in, wired in, or prewired at birth. . . .and therefore remain relatively unmodified with experience.
>
> . . . . . .
>
> It is this universal involvement of the process of information extraction in man's adaptive behavior which led me to believe that we must relate perception to the general problem of cognitive development if we are to understand fully the nature of the reception, acquisition, assimulation, and utilization of knowledge. Looked at in this way, perception becomes the core process in the acquisition of cognitive knowledge. I thus conceive of perception as the superset, with learning and thinking as subsets subsumed under the perceptual process.
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> . . . . . .
>
> Perception, learning, and thinking have traditionally been referred to as the cognitive processes since they all deal, to some extent, with the problem of knowledge. Perception can generally be defined as the process by which an organism receives or extracts certain information about the environment. Learning is defined as the process by which this information is acquired through experience and becomes part of the organism's storage of facts. (Forgus, 1966, pp. 1-2.)

III. MODALITIES AND ELEMENTS OF LEARNING STYLE

A review of currently available literature on learning styles indicates a confusion of terminology and concepts. For

example, the terms "Cognitive Style" and "Learning Styles" are often used interchangeably. During the winter quarter of 1980, a group of potential learning style researchers at The University of Tennessee, Knoxville met weekly to discuss the general thrust and results of past research in the area of personal learning style. In order to establish a common vocabulary, the group assembled the terms used by the various researchers, studied their definitions, and arranged those terms by definition into a pattern. It was decided that the most logical and appropriate overall term for this field of study was "Learning Style" (French, 1981). Additionally, the group determined that there were at least four subordinate or secondary categories under the broad term "Learning Style." Those secondary levels of the pattern were labeled "Modalities." The original four modalities identified were: Perceptual, Cognitive, Emotional. and Social. These modality identifications not only facilitate the organization of all past learning style terminology; they also reflect four areas of human learning activity: (1) information extraction by the senses; (2) mental processing of that information; (3) personal feeling, attitude, personality states which influence information gathering, knowledge building, and knowledge application, and (4) social sets which enhance or inhibit the learning process for the individual. These concepts are partially supported by the Forgus model of learning and thinking:

> . . . the three cognitive processes are closely interrelated and difficult to separate in practical

> situations. . . . at the beginning of this process, learning and thinking either are nonexistent or operate at a low level. . . . where information extraction requires more active effort on the part of the organism, learning and thinking play an increasingly important role. . . . thus we consider learning and thinking as events or processes which aid in the extraction of information.
>
> Having defined perception as the process of information extraction, it seems clear why we made it the parent construct, for adaptive behavior originates in perception.
>
> . . . . . .
>
> The relationship between learning and thinking in the perceptual process is diagramed . . .:
>
> Modifies perception of stimulus — Modifies organism
>
> Stimulus - - → Organism - - → Learning - - → Thinking
>
> Modifies perception of stimulus — Modifies organism through learning
>
> Stimuli possessing potential information are observed by the organism, which extracts some of the information present, aided by the process called learning. The learning modifies the organism so that perception of the same stimuli later will also be modified. . . . learning may lead to thinking; this thinking modifies the organism through the involvement of new learning, which in turn modifies the perception of the stimulus situation. (Forgus, 1966, pp. 3-4.)

By recognizing that learning and thinking involve emotion and social activity, the elements of Forgus's model can be closely related to the four modalities listed in the hierarchy.

Within the pattern of terms, The University of Tennessee group labeled the tertiary level "elements." The terms previously used to identify individual learning style differences were arranged as elements under the four modalities

to produce a logical pattern of communication. Example: The visual element of the perceptual modality of learning style; the field dependent-field independent element of the cognitive modality of learning style; the impulsive-reflective element of the emotional modality of learning style; or the collaborative vs. independent element of the social modality of learning style.

It must be noted that The University of Tennessee group agreed that some terms might represent elements of more than one modality, and rigorous research is needed to clearly establish both elements of the modalities and the modalities themselves. They also agreed that there is dynamic interaction among the various learning style modalities and elements. It was felt, however, that this tri-leveled conceptualization could serve as a foundation for future research and improved communication about learning style. This investigator was a member of The University of Tennessee research group, and the remainder of this review will reflect the hierarchical frame of reference established by that group.

A variety of style elements has been theorized and investigated by a variety of authors. Oen (1973) reviewed the available literature and prepared a matrix which cross-referenced 62 style elements and 18 authors. Seven of the 62 elements were used by more than one author, 13 of the 18 authors define no elements in common with the other authors, no element definition was common to more than three authors. Elements and authors related to this study include:

Element:	Author(s):
Visual	Riessman, Hill
Oral-Aural	Riessman, Hill
Physical/Tactile	Riessman, Hill
Perceptual/Conceptual	Davis
Auditory	Hill
Olfactory	Hill
Savory	Hill
Kinesthetic	Hill
Perceptual Strengths	Dunn and Dunn

(Oen, 1973, pp. 18-19.)

The authors listed above provided very few specific guidelines for this study. Davis's work is more related to the cognitive modality than any other. The other listed authors seem to be more in concert with the thrust of this study, but Riessman's work is more theoretical than specific, and research by the other listed authors is directed toward immediate application of their measurement findings in learning situations without much attention to issues such as validity of measurement.

This study focused on the perceptual modality elements conceptualized by French (1975): print, aural, oral (interactive), visual, tactile, motor, and olfactory. In 1975, French theorized that each learner has an individual orientation or preference in one or more of the sensory-intake styles. He encouraged teachers to observe learner activities in the various modes, identify each learner's orientation, and develop instructional strategies to match the student's learning style. French also suggested that extensive research was needed to product effective measurement instruments.

Gilley (1975) developed, tested, and validated the

Multi-Modal Paired Associates Learning Test to measure six of French's seven elements. Those six elements were: Print, aural, interactive visual, haptic (previously tactile), and kinesthetic. Gilley found that all modality elements could be effectively (validly, reliably) measured within all of his subjects using the MMPALT. He also found that third grade students possess individual differences in perceptual learning style, and the two most dominant styles were haptic and visual (pp. 79-80).

The visual, haptic, kinesthetic, and aural learning styles have received specific attention from several authors. Writing in The Culturally Deprived Child, Riessman (1962) identified seven unique characteristics of deprived children. One of those characteristics suggested that deprived children are, "physical and visual rather than aural." (p. 73.) In testing over 1100 subjects, Lowenfeld found the subject population to be 47 percent visual, 23 percent haptic, and 30 percent not identifiable (Lowenfeld, 1945). Barbe and Milone summarized their conclusions in a recent edition of Educational Leadership:

> The most frequent modality strengths are visual or mixed; each accounts for about 30 percent of the population (although mixed modality strengths are more frequent among adults than children). About 25 percent of the population are auditory, and the remaining 15 percent are kinesthetic.
>
> . . . . . .
>
> Primary grade children are more auditory than visual, and are least well developed kinesthetically. Between kindergarten and sixth grade, however, a modality shift occurs. Vision becomes the dominant modality, and kinesthesia overtakes audition.

. . . . . .

> Sometime between the late elementary grades and adulthood another shift occurs. Vision remains the dominant modality, but audition becomes more important than kinesthesia. (Barbe, 1981, p. 378.)

Age and grade developmental processes notwithstanding, it appears that style preferences do change within individual learners. Keefe contradicts one of Barbe and Milone's conclusions:

> Perceptual preference seems to evolve for most students from psychomotor (tactile/kinesthetic) to visual and aural as the learner matures. (Keefe, 1979, p. 127.)

The print, interactive, and olfactory styles have not been as well researched as the other style elements; however, they are included in the self-report measurement systems of some authors. Under the general heading "qualitative symbols," Hill (1976) includes considerations for both olfactory and savory styles. This study did not distinguish between taste and smell, as Hill has done, because objective measurements (revised MMPALT) were used, and olfactory measurements were not previously validated. Dunn and Dunn include both print and visual considerations in their styles elements; however, they use self-report measurement systems. The self-report approaches used to identify learner preferences have received little validation against measurements of actual strengths and weaknesses in student learning styles.

The seven elements of this study have received varying degrees of emphasis in previous research, and the terms used

have been applied to a variety of human skills. Some inconsistencies in measurement techniques exist. For example, the printed word often has been used to measure skills under the visual learning style. In aural measurements, some researchers require their subjects to use both speaking and listening skills, and others require only listening. No study, other than Gilley's, was found which objectively measured the interactive style. Visual learning is one of the more extensively researched areas; however, most of those studies focused on cognitive processes not perceptual strengths and weaknesses. The terms haptic, tactile, and kinesthetic have been used somewhat interchangeably, and one must use caution when correlating research results. No study was found which objectively measured the olfactory style. All these contradictions notwithstanding, it is apparent that the seven selected style elements do manifest themselves to varying degrees in individual learners, and they do merit careful measurement studies.

IV. MEASUREMENT OF LEARNING STYLE

Most of the objective measurements and validated subjective measurements of individual differences in learning processes have come from the field of psychology, and they tend to focus on mental processes or cognition. Some of those measurement approaches do, however, provide guidance for this study.

Lowenfeld (1945), as reported by Ragan, developed

numerous tests to measure what he called the visual-haptic elements of cognitive style. His testing procedure required subjects to combine partial visual impressions into whole visual images, to form visual images of items expressed kinesthetically, or to recognize figures perceived through tactile experiences. He based his testing on several theoretical distinctions between visuals and haptics:

> Whereas the visual has the ability to see a whole, break it up and see its component details, and then resynthesize the details back into a whole; the haptic is unable to do this.
>
> Whereas the visual tends to react to stimuli as a spectator and to "see" experiences, the haptic tends to react emotionally, to "feel" stimuli, and place self into the situation.
>
> Whereas the visual has the tendency and ability to visualize and integrate tactile and partial experiences, the haptic has neither this tendency nor ability.
>
> Whereas the visual has the ability to maintain visual imagery mentally, the haptic is unable to do this. (Ragan, et al., 1979, p. 21.)

One implication from Lowenfeld's work, as reported by Ragan, is important to this study. The materials used to measure visual, haptic, and the other style elements must be kept simple enough to minimize the cognitive processes of additional mental imagery or emotional reaction.

Versions of the Embedded-Figure Test have been used to measure the tactile, auditory, and visual elements of "cognitive style." These tests were found to be influenced by the subject's intellectual ability (Ragan, et al., 1979). Rohwer and Ammon (1971) point out that paired-associates testing requires

verbatim responses (p. 12), and Jensen, according to Rowen and Ammon, classifies verbatim responses as the lowest level of ability (p. 2). This need to minimize the impact of intellectual ability and cognitive activity on test results tends to support the revisions made in the MMPALT particularly the ten item cluster arrangement and a simplified scoring procedure.

The Stroop Color-Word Test has been used to measure the Distractibility element of cognitive style. In 1975, Golden developed a group version of the Stroop test. That newer version required written responses, and the results were found to be very reliable (.89, .84 and .73)(Ragan, et al., 1979). This and recommendations of Gilley tend to justify the group testing and written response procedures in three areas (print, aural, and visual) of the revised MMPALT.

Hill and his associates use a battery of tests and inventories to measure individual differences. Computer produced "cognitive maps" are then used to develop personalized programs of instruction (Hill, 1976). Numerous studies have supported the validity of Hill's system for determining learning style preferences but it is criticized in some areas. Sailor (1978) concluded that Hill's instrument:

> . . . appears to include a number of variables which seem to be of little value in assessing cognitive style and that a number of variables should be eliminated.

At the other extreme, Sheriff (1978) suggests that Hill's instrument fails to measure discrete variables. London's (1976) suggestion that the Hill model receive certain

fundamental structural and psychometric modifications is supported by Cogan (1976). Cogan classified Hill's instrument as a self-report instrument which is edumetric not psychometric. This tends to support this study's intent to examine the correlation between self-reporting (PMPS) and objective measurement (revised MMPALT) of individual learning styles.

The "Learning Styles Questionnaire," developed by Dunn and Dunn (1972,1977, and 1978), is designed to assist teachers in adjusting classroom activities to the learning styles of their students. The "Learning Styles Questionnaire" is also a self-report instrument, and it relies on teacher observations. Again, the validity of self-reporting was a question for this current study.

V. RESEARCH FINDINGS

Assessment of the perceptual styles of individuals is the major thrust of this study; group data while of secondary importance can be both interesting and useful, however.

Gilley's population of 24 third grade students consisted of 12 high achievers and 12 low achievers, as identified by standard achievement tests. In that study, both high achievers and low achievers demonstrated primary strengths in the haptic style and secondary strengths in the visual style. Specifically, Gilley's hierarchical (rank-order) findings were:

High Achievers	Low Achievers
1. Haptic	1. Haptic
2. Visual	2. Visual

3. Aural	3. Kinesthetic
4. Print	4. Aural
5. Kinesthetic	5. Interactive
6. Interactive	6. Print

(Gilley, 1975, p. 80.)

The rank-ordering of all measured styles is significant; however, researchers tend to emphasize student primary styles because these have direct implications for teaching practices. As previously reported, Riessman (1962) theorized that deprived children were strongest in the physical (Haptic/Kinesthetic) styles and needed to be taught in these modalities. The research findings of Lowenfeld indicate that adults are primarily visual learners. Barbe and Milone found primary grade children to be strongest in the auditory style. They also found that sixth grade students and adults were strongest in the visual style.

In summarizing research using self-reporting, Keefe (1979) has inferred that younger students are primarily psychomotor (tactile/kinesthetic) learners and adults are primarily visual or aural learners. Also using self-report data, Griggs and Brice found that non-gifted children preferred auditory learning (Keefe, 1979). The Griggs and Brice research data were collected on 170 seventh, eighth, and ninth grade students. Their instruments included the Stanford Achievement Tests and the Dunn, Dunn, and Brice Learning Styles inventory.

Based on extensive use of their instrument, Dunn, Dunn, and Brice conclude:

> . . . we are finding that the majority of the students tested are not auditory learners, ... It

> appears that many students are tactual and/or kinesthetic learners. The tendency to learn through the latter two senses appears to decrease with maturity but at least one-third of each high school sample tested exhibited such predispositions. Research also indicates that some students have strong perceptual strengths in several areas and that, almost without exception, these prove to be the high achievers. Slower learners tend to be either essentially tactual, visual-tactual, or tactual-kinesthetic. . . . Another interesting finding is that kinesthetic learners appear to be in need of frequent mobility; they find it difficult to "sit" and, of course, to "listen" for substantial amounts of time. (Keefe, 1979, p. 53.)

VI. SUMMARY

Literature on the specific concepts of perceptual differences in individual learning styles is very limited; however, related psychological literature has assisted in this study. The need for individualized instruction is based upon the assumption that individuals have a variety of learning differences. Central among those differences is sensory intake or perception; the perceptual modality is the individuals primary means of extracting information from the learning environment. This review included a hierarchy of terminology for learning style research, and seven elements in the perceptual modality. Past measurements of individual differences have focused on internal cognitive processes or self-reporting type instruments. Cognitive research has provided limited guidance for this current study of external information gathering. The value and validity of subjective self-reporting as compared to objective measurement was a major question for investigation. A review of specific research using both empirical measurement approaches

and self-report strategies gave direction to the investigation and provided information with which findings could be compared.

CHAPTER III

PROCEDURES

I. INTRODUCTION

The original MMPALT (Gilley, 1975) contained measurements for six elements of the perceptual modality and was used with a relatively small group of third grade students. Testing of an individual required several hours. For use in this study, the MMPALT was revised to accommodate a seventh element of the perceptual modality. Testing procedures were redeveloped to shorten the time of test administration and to accommodate a range of learners. The self-report questionnaire, Perceptual Modality Preference Survey (PMPS), was developed specifically for this project. A major need in this study was the recruitment of volunteer subjects to produce a subject population containing adult learners with varied backgrounds. Test administration to groups of 10 subjects required a minimum of 9 research assistants; therefore, the selection and training of those evaluators also became an important phase in this project. Ultimately, measurements were conducted in both individual and group situations. All data were computer processed to provide information for analysis.

II. REVISING THE MMPALT

This researcher met with Drs. Gilley and French on

March 10, 1980 to discuss this potential project and secure their recommendations and guidance. The original MMPALT (Gilley, 1975) used the paired associates testing procedure as its basic format. This procedure as developed in the MMPALT measures the subject's ability to remember information and/or discriminate among pieces of information provided in whatever presentation format is used. Although, the paired associates procedure may not measure all factors which together constitute perceptual style, the capacity to remember things or discriminate among things presented in various sensory modes is certainly central to the concept of perceptual style. Examination of the Gilley instrument led the investigator to conclude that its basic approach was valid, but that modifications were needed. Based on his original research and current initiatives, Gilley recommended the following modifications to the MMPALT instrument and administration procedures.

1. In order to save time, increase control, and reduce subject fatigue, reduce each style element measurement from 4 sets of 5 stimulus-response pairs and 10 trials to 1 set of 10 stimulus-response pairs and 1 trial.

2. Where possible, use 35MM slides, tape recordings, and written response sheets to allow group testing in certain style elements (e.g., 35MM slides and written responses in the print and visual element measurements; tape recordings and written responses in the aural element measurements).

3. Instead of introducing and practicing each

measurement on an individual basis with each subject, develop a procedure for introducing all measurement procedures to groups of subjects.

4. When developing the olfactory pairs or replacing any old pairs, retain the basic concept of the stimulus member being the more abstract and the response member being the more common.

5. When presenting stimulus-response pairs to the subjects, maintain a consistent spacing of 5-7 seconds between each pair, when receiving responses, adjust timing to the uniqueness of each element being measured, but keep that time to approximately 10 seconds between stimulus presentation and response recording.

Based on the above recommendations and review of pertinent literature, 10 stimulus-response pairs were selected, prepared, and assembled for measuring each of the 7 elements of the perceptual modality. An extra stimulus-response pair in each element was designed for use in the introductory procedures. Measurement procedures are described below:

Print

Print measurement consisted of each subject viewing pairs of printed trigrams (nonsense words) and common nouns on a screen and recalling the appropriate common noun when again viewing the trigrams. The 10 word pairs used in this study were the same as Gilley used in sets 1 and 2 of his original work, with one exception. One common noun (name) was

duplicated in both sets; therefore, another common noun (horse) was chosen from Gilley's third set. (Appendix C.)

Individual slides were prepared for each trigram and each common noun. Each word was printed in lower case letters and standard type. Use of slides assured consistency of color and light when the slides were projected. Type face in each slide was black and the background was off-white, thus producing the appearance of words typed on common paper or printed in a common book.

Slides were arranged in twin trays. One slide tray contained the trigram slides; the other contained the common noun slides. The slides in each tray were arranged in the order of Gilley's original pairs and projected simultaneously. To facilitate the recall or stimulus only presentation, duplicate trigrams slides were prepared. Those slides were arranged in a different order as determined by a table of random numbers and placed behind the first set of trigram slides. For the stimulus only (recall) presentation, a blank slide was placed after the last common word slide. Blanks were also used before each set of slides and between the trigram sets.

Slide projectors were arranged to accommodate projection of the trigrams on the upper half and common words on the lower half of a screen. The screen was placed five to eight feet from the subjects.

Aural

Aural measurement consisted of each subject listening

to spoken trigram and common noun pairs and recalling the appropriate common noun when next hearing the trigram. The 10 pairs for this measurement also originated in Gilley's research. The trigrams chosen were the same 10 and in the same order as Gilley's sets 1 and 2. The common words also came from Gilley's lists, but they were selected differently. Of the 20 words used in Gilley's 4 sets, 3 described items were pictured in the visual measurement; therefore, they were dropped from the list. The 10 common words chosen for the revised MMPALT were randomly selected from the remaining 17 words from Gilley's project. (Appendix C).

The word pairs were used to prepare a script to guide the recording of cassette tapes to be used in the measurements. In order to minimize any dialect or pronunciation influence in the recording and subsequent testing, this researcher solicited the aid of a professional broadcaster. Mr. Charles Swank (News Director of Radio Station WGAP, Maryville, Tennessee) volunteered to make the necessary recordings. Mr. Swank prepared two tapes; one for the pairs presentation to the subjects and another for the recall test. A table of random numbers was used to establish the order for the stimulus only (recall) presentation, and the time sequences suggested by Gilley were applied.

Interactive

Interactive perceptual style involves the learner's ability to acquire information through questioning and discussion.

Therefore, this measurement encouraged subject verbal participation in using pairs of trigrams and common nouns. Gilley required his subjects to repeat both words twice. The procedures were revised to require more than simple repetition from the subjects. Each subject was required to repeat each word pair, answer a question about that pair, and recall the common noun when next hearing the trigram.

Example: (Presenting the pairs)

Examiner: "The nonsense word in this pair is yag, and the common word is eye. Please repeat both words."

Subject: "Yag, Eye."

Examiner: "How will you remember this pair of words?"
(Allow approximately seven seconds for reply.)

(The recall test)

Examiner: "The nonsense word is yag; what was yag paired with?"
(Allow 10 seconds for the reply.)

Again, Gilley's first two sets were used to select the trigrams and common noun pairs. However, 1 of those 10 words also described a picture being used in the visual measurements. Therefore, a replacement word was randomly selected from Gilley's third set. The pairs presentation sequence was the same as originally outlined, but the recall test sequence was established by using a table of random numbers. A presentation and recall test script was prepared to guide the evaluator.

Visual

Visual measurement consisted of each subject seeing pairs of abstract symbol and common object pictures on a screen and recalling the appropriate common object when again seeing the abstract symbol. Gilley's original slides were not available for this project, therefore, both stimulus (abstract symbol) and response (common object) pictures were designed and produced specifically for this revision of the MMPALT.

Using the outline from Gilley's original pairs, this researcher and a professional graphic artist designed and produced the needed 35MM slides. Resultant pictures contained abstract symbols on a blue background and drawings of common objects on an off-white background. Duplicate slides of the abstract symbols were produced for use in the stimulus only (recall) measurement. Appendix C contains an outline of the symbols, and objects used for these pictures.

The slides were arranged in twin slide trays using a table of random numbers and the procedures previously stated for arranging the print measurement slides.

Haptic

Haptic measurement consisted of each subject, while blindfolded, holding and handling pairs of abstract and common objects and recalling the appropriate common object when again holding the abstract object. Gilley's original materials were not available, and objects were screened and selected specifically for the revised MMPALT. This researcher, using Gilley's

original outline as a guide, collected approximately 50 items for potential use in this project. With the general guideline of securing stimulus members that were abstract and response members that were common, a number of persons were asked to assist in classifying the items. The assistants were blindfolded and asked to hold each item and attempt to identify the object. Those items least frequently identified were considered abstract, and those most frequently identified were considered as common. The 10 items classified as the most abstract were selected for use as stimulus members; the 10 most often identified items were selected as response members. It should be noted that three of the abstract items were similar to stimulus members described by Gilley, and four of the common items were identical to items on his response list.

Using a table of random numbers, the items were paired and sequenced for presentation. The table was also used to determine the sequence of the stimulus only (recall) test. All items were arranged in a closed box, and a script was prepared to guide the evaluation process (Appendix C.)

Kinesthetic

Kinesthetic measurement consisted of each subject being guided and directed through pairs of body movements, and recalling by describing or performing the second movement in each pair when again being guided and directed through first movement. No revisions were required for these pairs; then 10 pairs used by Gilley in his first and second sets were used as presented.

The random order of the response test stimuli was, however, reaccomplished; Gilley did not provide random sequences for the use of two sets at the same time. A script and instructions were prepared to guide the evaluator. (Appendix C.)

Olfactory

Olfactory learning style relates to the individual's ability to receive information from his or her environment through the sense of smell. No measurement materials were available from past research, therefore, all materials were developed specifically for this revised MMPALT. The same criteria were used in selecting materials for this measurement as were used in developing the other six tests:

1. The stimulus and response members must be received by the subject through the sense (style element) being tested.

2. Stimulus members of each pair will be classified as abstract.

3. Response members of each pair will be classified as common.

With all testing of human subjects, safety is a prime consideration, but the nature of this measurement required that special emphasis be placed on safety. After consultations with an organic chemist, this researcher collected 30 potentially useful chemicals. Those chemicals were evaluated by the chemist, and two were rejected from potential use. One was deemed potentially dangerous to subjects with allergies, and the other did not have human consumption certification.

Again, a number of persons were used to classify the chemical smells as abstract or common. The smells least frequently identified were classified abstract, and those most frequently identified were classified common. The abstract and common smells were then paired and sequenced with the aid of a table of random numbers. The table was also used to establish the recall test stimuli sequence.

Special containers were used in this measurement. Twenty identical glass vials with screw-on caps were purchased; cotton balls were placed in the bottom of each vial, and a few drops of chemical were put into each vial. This process increased the aromatic qualities of the chemicals, prevented accidental spilling, and removed the possibility of the smell being identified by the size or shape of its container Code labels were placed on each vial, but they were kept in a closed box until the subjects were blindfolded.

III. DEVELOPING THE PERCEPTUAL MODALITY PREFERENCE SURVEY

The Perceptual Modality Preference Survey (PMPS) required each subject to respond to 42 questions about his or her own learning style. Its purpose was to provide quantified data on each subject's opinion about his or her strengths and weaknesses in each of the seven perceptual modality elements. The data provided by this instrument were used to compare learner self-reporting with the objective data produced by the revised MMPALT.

The initial construction of the PMPS was hampered by the lack of a similar instrument. Two self-report instruments (Dunn and Dunn, 1978; Hill, 1974) were examined for potential use with this study. Both were found inappropriate for this study and extremely limited in aiding the development of a new instrument. Surveys using the semantic differential or Likert formats provided the initial direction for building the PMPS. A draft PMPS was designed which included questions contrasting style elements (. . . read better than listen . . .) and answers based on degrees of truth (absolutely true, true, false, and absolutely false). By contrasting each style element with each of the other elements twice, 42 questions were produced.

The draft PMPS was submitted to questionnaire development experts for review and comment. Based on the critique's of these experts, the questions and possible answers were rewritten and reevaluated three times. The final wording and format included the original 42 question contrasting elements approach. The two positive (acceptance) and two negative (rejection) answer format also remained the same, but the response options were given an element of time reference: always, usually, seldom, never. (Appendix D.)

Based on the eventual need to rank order the seven styles elements for each subject, it was determined that the scoring system must produce maximum separation between the elements without giving undue value to any question or answer. Each answer, as finalized, reflected the subject's acceptance

of one element and rejection of another; therefore, it was determined that both style elements in each question should receive a score value. (See Figure 1, page 10, for explanation of scoring system.) The scoring system design and values were evaluated and approved by a statistician.

After preparing an introductory cover sheet, this researcher field-tested the survey on a number of persons. All participants in the test found the survey clear, understandable, and easy to answer. The scoring system produced the desired rank ordering, and all participants agreed that the results reflected their opinions about their perceptual learning styles. All participants completed the survey in less than fifteen minutes.

A sufficient number of duplicate surveys and optical scan answer sheets were secured to support the measurement project.

IV. OBTAINING AND PROCESSING THE SUBJECTS

Invitations

Potential subjects in the various potential subject groups received either written or spoken invitations to participate in this project. The invitations stressed two potential rewards for participants: each subject would have an opportunity to contribute to the general knowledge about learning styles, and each subject could also learn more about themselves and their own uniqueness as a learner. No other form of

persuasion was used to secure subjects. The need for genuine and enthusiastic interest on the part of each subject was considered an important element in securing volunteer subjects.

Volunteers

Those receiving written invitations also received a written introduction to learning styles measurement and a sign-up card. (Appendix A.) Most subjects, however, chose to schedule their measurement appointments by personally contacting the researcher.

As previously stated, participants in four programs received letters of invitation, and educational colleagues received verbal invitations. The four cooperating programs were:

1. The Aluminum Company of America (ALCOA) apprenticeship program at Alcoa, Tennessee;

2. The Adult Basic Education (ABE) program for Blount County, Tennessee;

3. The counseling and rehabilitation services offered at the Blount County Jail, Maryville, Tennessee;

4. The three leadership development courses offered at the I.G. Brown Air National Guard (ANG) Professional Military Education Center (PMEC) McGhee Tyson Airport, Knoxville, Tennessee.

From a mailing of 247 letters, only one Alcoa apprentice participated in the project. This subject was a 36 year old male. He is a high school graduate and resides in Tennessee.

Approximately 90 letters were distributed at the ABE center's processing desk. Nine ABE students volunteered for the measurements. This group consisted of three males and six females. They averaged 27 years of age and 10.6 years of formal education. All were Tennessee residents.

Of the twelve jail inmates invited, seven agreed to participate in the measurement project. This all male group averaged 26 years of age and 10.9 years of formal education. All of these subjects consider Tennessee as their home of residence.

Approximately 240 letters were distributed to the students and faculty of the I.G. Brown PMEC. Sixty students from the three PMEC programs volunteered for the project. This group consisted of 54 males and 6 females. They averaged 34 years of age and 14.1 years of formal education. They were residents of 31 different states. (Appendix E.)

Thirty-four of the PMEC subjects were involved in a mid-level enlisted leadership course, The Noncommissioned Officers Academy (NCOA). This group contained 32 males and 2 females. They averaged 37.9 years of age and 13.3 years of formal education. They were residents of 23 different states.

Twenty of the PMEC subjects were enrolled in an officer pre-commissioning program, The Academy of Military Science (AMS). This group contained 18 males and 2 females. They averaged 28.8 years of age and 15.4 years of formal education. They were residents of 16 different states.

Six of the PMEC subjects were students in a junior noncommissioned officer leadership development course, The Leadership School (LS). This group consisted of four males and two females. They averaged 29.5 years of age and 14.3 years of formal education. They were residents of six different states.

It is estimated that approximately 100 educational colleagues of this researcher were told about this project and given an opportunity to have their learning styles measured. These colleagues included teachers, professors, and fellow students. Nineteen individuals volunteered for the project. This group consisted of 11 males and 8 females. They averaged 41 years of age and 14.7 years of formal education. All were residents of Tennessee. The first 10 members of this group were used to test and evaluate the measurement procedures.

Scheduling

The first period for conducting measurements was September 1, 1980 through September 15, 1980. Ten subjects were measured during the period. All subjects were educational colleagues of this researcher, and all measurements were conducted in the researcher's home by the researcher.

It had previously been determined that this first group would be used to test and evaluate the measurement processes. After completing the measurements and hand processing the derived data, the researcher and his major professor decided that no changes were needed in the methods or procedures.

Therefore, all data obtained on the original subjects were retained for the final report, and invitations were extended to other potential participants.

Specific dates and places were scheduled and announced for conducting the measurements, but individuals and groups requested to be measured at a variety of places and on a variety of times. Wherever possible those requests were honored. Table I is a summary of measurement dates, places, and number of subjects.

The integrity of the measurement process was assured on all dates and at all locations. The subjects were always processed and measured in accordance with written instructions, and all measurements were conducted by either this researcher or trained evaluators.

V. TRAINING EVALUATORS

Like the subjects, all evaluators were volunteers. The two sources of potential evaluators were the family members and friends of this researcher who assisted in the development of the materials and subjects who had previously been measured. As individuals demonstrated a special interest in and understanding of this project, they were invited to assist in future measurements. Fifteen volunteer evaluators were used in the project. Objectivity in evaluation was obtained by standardizing the assessment/evaluation procedures as well as the training procedures for evaluators.

TABLE I

SUMMARY OF DATES, PLACES, AND SUBJECTS MEASURED

Date	Place	Subjects
September 1-15	Researcher's Home	10
September 20	McGhee Tyson Airbase *	5
September 24	Researcher's Home	1
September 25	University of Tennessee Campus	1
September 27	Local 309 Union Hall **	1
October 4	Local 309 Union Hall	4
October 4	McGhee Tyson Airbase	16
October 5	McGhee Tyson Airbase	6
October 11	McGhee Tyson Airbase	10
October 16	Researcher's Home	4
October 19	McGhee Tyson Airbase	5
October 30	Researcher's Home	4
November 1	McGhee Tyson Airbase	21
November 4	Researcher's Home	2
November 6	Researcher's Home	4
November 12	Researcher's Home	2
		96

*The I.G. Brown Air National Guard Professional Military Education Center, McGhee Tyson Airbase, Knoxville, Tennessee.

**United Steelworkers of America Local 309, Alcoa, Tennessee.

All evaluators were individually trained by this researcher. The training was in three phases and required a total time of one hour or less. Phase one of the training consisted of the volunteer evaluator and this researcher mutually deciding which of the revised MMPALT test elements would be administered by the new evaluator. Each evaluator was trained to administer only one sub-test of the total test battery. It should be noted that this researcher administered all Perceptual Modality Preference Surveys and all print, aural, and visual measurement elements of the revised MMPALT. Phase two of the training consisted of the new evaluator reading the printed instructions, examining the measurement materials, and asking questions. Phase three involved the new evaluator in practicing the procedures with this researcher or a previously trained evaluator. As necessary, some new evaluators served as assistants to this researcher or another evaluator until they were able to objectively conduct the measurements.

This researcher validated the training process by periodically observing each evaluator conducting actual measurements. Additionally, evaluators were assigned to work in pairs, given the responsibility to correct one another as necessary, and instructed to report any problems to this researcher. There were no observed or reported problems in the performance of the volunteer evaluators.

VI. CONDUCTING THE MEASUREMENTS

Staffing

Once a firm commitment was received, schedules were established to conduct the measurements. For single subject measurements, the researcher worked either alone or with one trained evaluator. When two or more subjects were to be measured, trained evaluators were recruited and scheduled as necessary. Example: four subjects required four additional evaluators. All schedules were controlled and balanced to prevent delays in subject processing.

Station A

As the subjects arrived at the measurement location, they were immediately processed according to procedures labeled "Station A." (Appendix B.) It was first determined that each subject had read and understood the learning styles measurement introduction and had completed the necessary sign-up card. Each subject was then assigned a four digit code number to protect his or her individual identity and aid in later data processing. The first digit indicated the subject's testing location, the second his or her category (subgroup), and the last two digits were individual identification numbers.

After initial in-processing, the subjects were welcomed by this researcher, and they received a formal introduction to the measurement process. The introduction included a brief discussion of learning styles in general and the seven

perceptual modality elements specifically, an explanation of the reasons for measuring learning styles, a full demonstration of the measurement procedures to be used, and a question and answer session. Emphasis was placed on the need to do as well as possible on each of the measurements, but it was also stressed that the procedures were measurements, not pass or fail testing. One of the goals of the introduction was to prepare each subject for the measurements without raising anxieties or reducing motivation and enthusiasm.

At the conclusion of the question and answer period, subjects holding odd numbers were assigned to an area designated as "Station C," and subjects with even numbers were directed to an area designated as "Station B." This process facilitated subject flow through the various measurements. It allowed odd numbered subjects to complete the PMPS before starting the revised MMPALT measurements and also allowed even numbered subjects to complete all seven revised MMPALT measurements before responding to the PMPS. The complete Station A processing and introduction required between 20 and 45 minutes, depending on the size of the group, their past knowledge of learning styles concepts, and their ability to understand the measurement procedures.

Station B

Procedures labeled "Station B" included four measurement sections of the revised MMPALT: interactive, haptic, kinesthetic, and olfactory. All measurements were conducted

on an individual basis in individual rooms. When two or more subjects were being tested, a coordinator was used to direct subjects through the various measurement rooms.

Interactive. For this measurement, the evaluator welcomed each subject and attempted to make him or her feel relaxed and comfortable. The subject was seated facing the evaluator. The evaluator again explained the measurement procedures and answered questions as necessary. Using the prepared script, the evaluator presented the 10 pairs of trigrams and common nouns to the subject. The subject was encouraged to discuss each pair as it was presented. After a few seconds pause, the evaluator used the randomized list of trigrams and script to conduct the response test. As each trigram was spoken, the subject was allowed 10 seconds to supply the appropriate common noun response. Either the evaluator or the assistant scored the responses on a prepared answer sheet. The answer sheet was kept out of the subjects view; subjects were not told if the responses were correct or incorrect, and the subjects were not told their final score. At the conclusion of this measurement, the subject was directed to the next measurement area.

Haptic. Again, the subject was welcomed, and it was determined that he or she understood the procedures for this measurement. The subject was seated across a small table from the evaluator and blindfolded. Without speaking, the evaluator opened the container and proceeded to place each pair of objects

in the subject's hands. The subject was allowed seven seconds to hold and manipulate the objects. After the subject had received all 10 pairs, the evaluator followed the randomized list to place each stimulus object in the subject's hand. The subject was allowed 10 seconds to describe or name the appropriate common object of the pair. Scoring was done on a prepared answer sheet by the evaluator or the assistant. The subject was not informed about the correctness of his or her responses. The blindfold was removed, and the subject was directed to the next area.

Kinesthetic. After the usual welcome and assurance that the procedures were understood, the subject was placed in a standing position near the center of the test area and blindfolded. The evaluator stood behind the subject and guided the subject through the body movement pairs by grasping the subject's shoulders. Spoken directions were used as necessary, but they were kept to a minimum. To minimize confusion and create a clear separation between the pairs, the evaluator would say, "This movement is (stimulus) . . . It is paired with (response). . . ." Upon completing the 10 pairs, the evaluator guided the subject through each of the randomized stimulus only movements. The subject was allowed 10 seconds to respond by describing or performing the appropriate response movement. The evaluator or the assistant scored the responses on the appropriate form, but the subject was not informed of the test results. After removing the blindfold, the subject was

directed to the next area.

Olfactory. After the subject received the usual welcome and check for understanding of the procedures, he or she was seated at a small table across from the evaluator and blindfolded. The subject was cautioned to handle the aroma vials carefully, and the evaluator was cautious not to spill the vials. Some spoken directions were used in this measurement. Specifically, the evaluator removed the cap from a stimulus vial, placed the vial in the subject's hand, and said, "This is the first aroma of this pair." The subject lifted the vial to his or her nose for a few seconds and returned it to the evaluator. The evaluator replaced the cap on the first vial, removed the cap from the response vial, placed the vial in the subject's hand, and said, "This is the second aroma in this pair." To assure common terminology, the evaluator stated the name of the second aroma as the subject was smelling it, unless the subject identified it first. The subject then returned the vial to the evaluator who replaced the cap and prepared the next pair.

After all 10 pairs were presented, the evaluator conducted the recall test. Each stimulus vial was presented to the subject in randomized order. The subject was allowed 10 seconds to sniff the aroma and state the name of the appropriate response member smell. As in the other measurements, the evaluator or assistant scored the responses without indicating to the subject his or her correctness or incorrectness.

After removing the blindfold, the subject was directed to the next area.

Coordinating. When two or more subjects were being measured at Station B, the coordinator was responsible for several activities. This person assured that each subject received all four measurements without confusion or delays. Each measurement required between 10 and 15 minutes; the coordinator was responsible for preventing the subjects from talking about the various measurements while they were waiting. The coordinator also was responsible for the collection of score sheets, and the transferring of individual measurement scores to each subject's initial report sheet. (Appendix B.)

As odd numbered subjects completed the Station B measurements, the coordinator finalized each subject's report sheet and directed him or her to discuss the results with the researcher before leaving.

As even numbered subjects completed the Station B measurements, the coordinator directed them to the area designated as "Station C."

Station C

All activities at Station C were conducted in one room with groups of subjects. The researcher administered all Station C procedures. Activities at this station were the print, aural, and visual measurement sections of the revised MMPALT and completion of the PMPS. Odd numbered subjects completed the PMPS as their first activity at Station C. Even

numbered subjects completed the PMPS as their last activity at Station C.

As subjects arrived at Station C, they were allowed a brief period of general conversation. This provided an opportunity for the subjects to ask questions, clarify their understanding of the procedures, and prepare themselves for the measurements.

Print. After a brief review of the procedures, the subjects were seated at tables facing and approximately six feet in front of a white screen. The subjects were provided response forms and pencils; they were instructed to enter their subject numbers on the forms. When there were two or more subjects, they were spaced to prevent eye contact with one another's response sheets. The evaluator directed the subjects to place their pencils on the table, relax, and concentrate on the screen. Using twin Kodak Carousel projectors, the evaluator projected the 35MM slide pairs of trigrams (nonsense words) and common nouns onto the screen. The trigram was projected on the upper half of the screen and the common noun on the lower half. Each pair was displayed for seven seconds.

After presenting all 10 pairs, the evaluator instructed the subjects to pick up their pencils and prepare to write their responses by the appropriate number on the response sheets. As the evaluator projected each stimulus trigram on the upper half of the screen, he announced the number of that slide, e.g., "Number one, Number two, etc. . . ." The subjects were allowed

10 seconds to see each trigram and record their responses. After projecting all 10 stimulus trigrams, the evaluator collected the response sheets and prepared for the next measurement.

Aural. The subjects were again supplied response sheets and pencils. They were instructed to enter their subject numbers on the forms and prepare to listen to a tape recording. For this measurement the subjects were blindfolded during the pairs presentation, but the blindfolds were removed for the response test. Therefore, the subjects were given blindfolds and asked to prepare themselves to receive the pairs. The evaluator presented the pairs by way of a compact cassette tape player. The player speaker was positioned directly in front of and approximately six feet from the subjects. The tape recording contained a brief introduction to the pairs to allow the subjects to acquaint themselves with the speaker's voice. The tape recording allowed seven seconds between each pair of trigrams and common nouns.

After all pairs were presented, the evaluator stopped the player, changed tapes, instructed the subjects to remove their blindfolds, and started playing the response test tape. The tape recording contained all other instructions to the subjects and allowed 10 seconds for each written response. When the test was completed, the evaluator stopped the tape player and collected the response sheets.

PMPS. For completion of the survey, the subjects were given optical scan answer sheets and pencils. They were

instructed to enter their code number, years of formal education, and birth dates in the appropriate blocks on the form. This provided an opportunity for the evaluator to assure that each subject knew the proper method for marking the answer sheets. The subjects were then instructed to read the PMPS instructions and begin the survey. The evaluator carefully observed the subjects as they read the instructions, and, as needed, assisted subjects with poor reading skills. In one case, a subject was taken to another room, and the evaluator read the entire survey to him. As the subjects worked on their surveys, the evaluator would stay in the room and grade response sheets from the print, aural, and visual measurements or prepare the materials for the next measurements. As each subject completed the survey, the evaluator checked the answer forms for completeness and proper marking. The materials were collected, and the subjects directed to their next activity. Odd numbered subjects were prepared for the other three measurements at Station C, and even numbered subjects were presented their final report of revised MMPALT measurements.

Post-Measurement Reports

Upon completing all measurements, each subject received a report of his or her revised MMPALT results. Those reports included the raw scores from each of the seven measurements and the rank order of the seven perceptual modality elements. The researcher discussed the results with each subject, and answered any questions about the procedures or scores. Each

subject was thanked for participating in the project and told that this completed the activities of the day.

VII. PROCESSING THE MEASUREMENT DATA

Upon completing the measurements, the raw data consisted of each subject's self-marked optical scan answer sheet for the PMPS, a score sheet from each of the seven measurements in the revised MMPALT for each subject, and a copy of the first report sheet for each subject's revised MMPALT results.

Data processing procedures included the validation of all documents and preparation of the data for computer processing. Each of the seven revised MMPALT score sheets for each subject was checked for errors and validated against each subject's final report sheet. Each subject's PMPS response sheet was checked for stray or improper marking. To facilitate machine processing, the data from each subject's final report of revised MMPALT measurements were transferred to open areas on his or her PMPS optical scan answer sheet. The scan forms were machine read and the data transferred to an 800 B.P.I. computer tape.

The next procedure involved preparing a computer program for processing the data. Under the directions of professional computer programmers at The University of Tennessee Computing Center, a program was developed to score the PMPS responses, rank order the seven style elements as reported by

each subject on the PMPS, report the rank orders from each subject's revised MMPALT measurements, and calculate a Spearman's rank order correlation coefficient (adjusted for ties) for the two rank orders for each subject. Additionally, the computer program was developed to process subject group data in a like manner. Using individual subject scores from the PMPS and revised MMPALT, scores were totaled, ranked, and correlated for the total subject population and each subject population subgroup. To assure correctness of the computer program and machine processing, selected individual and group data were hand processed and checked against the final IBM computer product.

The final procedure for data processing involved analyzing the computer produced statistical data against the research questions and established criterion reported in Chapter I. The report of that analysis comprises Chapter IV of this work.

VIII. SUMMARY

This research involved developing and using two measurement instruments, accommodating the needs of volunteer subjects, training volunteer evaluators, conducting the measurements, and computer processing the measurement data.

The first instrument was a revision of Gilley's multimodal paired associates learning test. The revisions included the preparation and production of 35MM slides to accommodate

group measurements of the print and visual perceptual modality elements, the preparation and production of audio tapes to allow group measurements of the aural element, and securing and organizing new materials to support the haptic and olfactory measurements.

The Perceptual Modality Preference Survey was developed specifically for this study. The use of contrasting terms and opposed answers was suggested by Likert type questionnaires. Survey development was guided, directed, and evaluated by experts in the field.

Ninety-six subjects were processed through the two measurements at four different locations. After the first 10 subjects were processed, results and procedures were evaluated and retained without modifications.

Family members, friends and former subjects of the research were trained to assist in the measurement process. Their training included both study and practice in the measurement procedures.

Measurements were conducted under controlled conditions and guided by specific directions. Those directions dictated the presentations of stimulus-response pairs and administration of recall tests in the revised MMPALT measurements. The directions also guided the administration of the PMPS and student processing.

The subject measurement data was computer processed to produce rank orders and correlations. An analysis of that data constitutes the contents of Chapter IV of this work.

CHAPTER IV

ANALYSIS OF DATA

I. INTRODUCTION

Learning style assessment is most useful in individualizing instruction. Data are primarily important in structuring teaching and learning for the individual. Any study of learning style must maintain as its primary focus the individual. In this study, computer resources were used to score the PMPS, rank-order the subject's scores from both the PMPS and the revised MMPALT, and calculate correlations between the two rank-orders.

Group data, though secondary in importance, were valuable to this investigator in analyzing trends and formulating questions for future research. Group data were obtained by summarizing individual data. Computer resources were used to identify the members of the 23 subject groups. Individual subject scores from the PMPS and revised MMPALT were summarized to produce group rank-orders. Correlation coefficients were calculated for each pair of group rank-orders.

Individual subject and group data were compiled in summary tables. Appendix F contains group tables, and Appendix G contains tables pertaining to individual subjects. These tables were used as the basis for developing findings and conclusions.

Five study questions (Chapter I) were used as the basic

organizational pattern for this chapter. Those questions also provided the general criteria for data analysis.

Chapter Organization

In each section of this chapter, data discussed result from scores on the PMPS and revised MMPALT measurements. The PMPS is a questionnaire (self-report) designed to identify each subject's personal assessment of his or her own learning style. It is, as the name implies, a preference survey. The revised MMPALT, on the other hand, is an objective measurement of each subject's actual strengths and weaknesses in the various style elements.

In section II, revised MMPALT data are used to address the first study question: Do the seven perceptual styles identified by French manifest themselves in adults? Gilley (1975) concluded that individuals do receive and process information differently; no two children had exactly the same hierarchical alignment of styles (p.). It was assumed, therefore, that similar alignments or rank-order ranges in this study would indicate the existence of the same elements in this adult population.

In section III, both revised MMPALT and PMPS data are used to address the second study question: Are there measurable variations in the perceptual learning styles of adults? It was assumed that variability in score ranges and variability in highest ranked style elements were directly related to this study question.

Both revised MMPALT and PMPS data are used in section IV.

Subject group preferences (PMPS) and strengths (revised MMPALT) are examined to determine the existence or absence of identifiable patterns of group learning style in keeping with study question number three: Are there dominant identifiable patterns of perceptual style within/across various groups of adult learners? The idea of dominance suggested emphasizing the highest ranked styles; therefore, group primary (highest ranked) and group secondary (second highest ranked) styles are specifically identified.

In Section V, revised MMPALT group rank-orders are compared to the rank-ordering of styles, found by Gilley, in children. These comparisons are reported to identify the relationship between Gilley's two categories (high and low achievers) and three revised MMPALT subject groupings: the total subject group, those with less than 12 years of education, and those with more than 16 years of education. It was assumed that these correlations, as categorized on the Best (1959) scale, could be used to address study question number four: How do the measurements of perceptual styles in adults compare/contrast with the measurements conducted earlier by Gilley in children?

Revised MMPALT and PMPS correlation data are used in Section VI to address study question number five: Do adult learner self-assessments of their perceptual modalities of learning styles show positive correlation with empirical measurement of the same styles? Both individual and group

correlations are reported in the various categories of significance reported by Best (1959).

II. RANK-ORDER RANGES

Gilley (1975) substantiated his assumption that individuals receive and process information differently (p. 83). His graphed findings showed that no two children had exactly the same hierarchical (rank-ordering) alignment of styles (pp. 57-64). Gilley, therefore, concluded that the six theoretical styles elements in his study do exist as sensory-input learning styles (p. 87). Similar findings in this study would, therefore, warrant the same conclusion for this adult population.

An examination of both the scores and rank-orders obtained from the revised MMPALT (Appendix G) revealed two facts. First, no two subjects had identical scores or score patterns. Second, only two subjects had identical rank-order alignments, and their scores were not identical.

Table II provides a visual comparison of the revised MMPALT rank-order findings of this study to Gilley's rank-order findings. Three considerations are important when examining the table. First, Gilley measured only six style elements; this study measured a seventh element (olfactory). Second, the possibility of a subject having equal strengths in 2 or more style elements created 13 potential rank-order positions on the revised MMPALT and 11 potential rank-order positions on Gilley's measurements. Third, this study's population (96

subjects) was four times larger than Gilley's (24 subjects). The following findings are obvious in Table II:

1. Gilley's subject population covered 47 of the 66 (71 percent) potential rank-order positions. This study's subject population covered 78 of the 91 (86 percent) potential rank-order positions. When adjusted for the difference in population size (dropping all positions with less than three subjects), this study's subject population covered 62 of the 91 (68 percent) potential rank-order positions. When adjusted for the added element and population size difference (dropping the olfactory positions and those positions with fewer than three subjects) this study's population covered 54 of the 66 (82 percent) potential rank-order positions.

2. Gilley's subjects scored over 85 percent of the potential rank-order range. Gilley reported finding no subjects in the first three positions of the interactive range, the last position of visual, the last four positions of haptic, or the first two positions of kinesthetic. This study's subjects scored in 91 percent of the potential rank-order positions. No subjects were found in the last (seventh) position of the interactive range, the last two positions of visual and haptic, or the first three positions of olfactory. When adjusted for the difference in population size, this study's population covered 70 percent of the potential rank-order range. When adjusted for the added element and population size difference, this study's population covered 83 percent of the potential rank-order range.

TABLE II

COMPARATIVE SUMMARY OF PERCEPTUAL STYLE STRENGTHS DEMONSTRATED BY ADULTS ON THE REVISED MULTI-MODAL PAIRED ASSOCIATES LEARNING TEST AND BY CHILDREN ON THE MMPALT AS ADMINISTERED BY GILLEY (PARENTHETICAL ENTRY)

Rank Order	Number of Subjects Registering Strengths by Element — Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	Olfac-tory
1	3(1)	3(3)	4	48(6)	8(10)	1	
1.5	4(1)	5	4	19(3)	8(4)		
2	9	12(4)	11	13(5)	18(3)	1(2)	
2.5	6(1)	10(3)	4(1)	6(2)	11(1)	4(2)	1
3	12(3)	9(1)	9(3)	5(5)	13(3)	4(4)	2
3.5	9	8(1)	15(1)	2	7(1)	5(1)	
4	8(3)	10(5)	18(2)	1(1)	10(2)	4(7)	
4.5	9	8	12(1)	(1)	4	7	2
5	10(10)	13(5)	7(4)	1	9	16(2)	2
5.5	6(1)	6	5(1)	(1)	2	9(1)	4
6	11(4)	7(2)	6(11)	1	6	28(5)	12
6.5	5	2	1			9	13
7	4	3				8	60

In summary, a strong similarity does exist between the range and profile findings in this study and those found by Gilley in his study. The findings confirm that the seven perceptual styles identified by French did manifest themselves in this adult population.

III. VARIABILITY OF STYLE

The issue of style variability within the adult population was addressed by examining both actual variations and perceived variations in individual learning style. Actual variations as determined by revised MMPALT measurements and perceived variations as determined by the PMPS questionnaire are used in this analysis. These two data bases provided two types of information related to this investigation. The first was score ranges within each style element. The second was the highest ranked styles for the various subjects.

The score range information from both the revised MMPALT and the PMPS is summarized in Tables III and IV. Those summaries were used to determine variability within each style element.

The highest ranked styles from both the revised MMPALT and the PMPS are summarized in Table V. Three rank-order categories were identified for this summary. The term "primary style" is used to identify a single dominant (revised MMPALT) or preferred (PMPS) learning style. The term "secondary style" is used to identify the second ranked style of those subjects

TABLE III

SUMMARY OF REVISED MULTI-MODAL PAIRED ASSOCIATES LEARNING TEST SCORES FOR NINETY-SIX ADULTS

	—— Number of Subjects Per Score ——															
Style	0	1	2	3	4	5	6	7	8	9	10	Range	(Spread)	Mean	Median	Mode
Print	11	8	7	9	8	13	9	12	7	7	5	0 - 10	(11)	4.72	4.88	5
Aural	4	9	8	10	14	8	11	11	9	9	3	0 - 10	(11)	4.97	4.88	4
Inter-active	2	8	11	11	14	8	14	12	9	3	4	0 - 10	(11)	4.85	4.75	4, 6
Visual	1	1	3	5	5	4	8	11	9	23	26	0 - 10	(11)	7.56	8.54	10
Haptic	1	2	10	10	15	13	11	10	6	11	7	0 - 10	(11)	5.52	5.27	4
Kines-thetic	7	17	17	22	16	10	4	2	1	0	0	0 - 8	(9)	2.89	2.82	3
Olfac-tory	34	33	18	9	2	0	0	0	0	0	0	0 - 4	(5)	1.08	.92	0

TABLE IV

SUMMARY OF PERCEPTUAL MODALITY PREFERENCE SURVEY SCORES
FOR NINETY-SIX ADULTS

Style	—— Subject Distribution by Score Categories —— (-36 -28)	(-27 -17)	(-16 -6)	(-5 +5)	(+6 +16)	(+17 +27)	(+28 +36)	Range(Spread)	Mean	Median	Mode
Print	3	7	19	30	15	17	5	-30 +33(64)	2.53	2.50	-9, -2
Aural	0	1	26	35	27	6	1	-19 +31(51)	1.52	1.88	2
Inter-active	0	0	5	33	40	16	2	-14 +31(46)	8.23	8.00	8
Visual	0	0	8	29	40	12	7	-14 +31(46)	8.32	7.50	11
Haptic	0	14	33	25	13	8	3	-27 +33(61)	-2.61	-5.00	-7, -6
Kines-thetic	0	6	11	12	29	29	9	-31 +36(68)	9.33	11.83	7, 21
Olfac-tory	46	38	10	2	0	0	0	-36 +4 (41)	-25.28	-27.00	-36,-33, -18

TABLE V

SUMMARY OF PRIMARY, MULTIPLE PRIMARY, AND SECONDARY STYLES

	Number of Subjects with:			
	Primary		Secondary	
Style	PMPS	*(r)MMPALT	PMPS	*(r)MMPALT
Print(P)	16	3	9	6
Aural (A)	4	3	10	9
Interactive (I)	14	4	23	7
Visual (V)	14	48	23	7
Haptic (H)	8	8	10	13
Kinesthetic (K)	36	1	15	1
Olfactory (O)	0	0	0	0
Combinations of Multiple Style:				
P,A,V,H,		2		
P,A,I		1		
P,I,V		1		
P,V,H,		1		
A,V,H,		2		
I,V,H,		2		
P,V,	2	3		
P,H,		1		
A,V,		5		
I,V,		4		
I,K	2			
V,H,		7		

*revised

with a single dominant or preferred style. Because of tied scores, it was possible for the subjects to have equally high rankings in two or more styles. Therefore, the term "multiple primary style" is used to identify multiple dominance (revised MMPALT) or multiple preference (PMPS) in perceptual style. Table V, page 78, was used to determine the degree of variability across style elements.

The summary of revised MMPALT scores (Table III, page 76) reveals the following facts.

1. Ninety percent of the possible positions within the scoring range were used by the subject population.

2. The full, 11 point, scoring range was used for 5 of the 7 perceptual style elements.

3. Eighty-two percent of the available scoring range was used for the kinesthetic style element.

4. Forty-five percent of the available scoring range was used for the olfactory style element.

The subjects (91 adults) demonstrated variability in revised MMPALT scores. It is apparent that the olfactory perceptual style is not particularly strong in this adult population, but the five point range of scores does indicate variability within the subject population.

The PMPS scores are summarized in Table IV, page 77. For ease of reading, possible scores have been arbitrarily grouped into seven categories. An examination of Table IV, page 77, reveals a clustering of scores around the mid-point in

six of the style elements. However, the question of variability requires an examination of the score ranges. Of the 73 available score positions, 64 (88 percent) were used for print, 51 (70 percent) were used for aural, 46 (63 percent) were used for both interactive and visual, 61 (84 percent) were used for haptic, 68 (93 percent) were used for kinesthetic, and 41 (56 percent) were used for olfactory. Overall 74 percent of the available scoring range was used by the subject population.

Again scores pertaining to the olfactory element demonstrated the narrowest variability, but there are measurable variations in the preferred perceptual styles of this adult population.

Variability across the respective style elements is depicted in Table V, page 78. An examination of that table reveals that six of the seven style elements (82 percent) were ranked as either primary (highest ranked) or secondary (second highest ranked) by one or more subjects on both the revised MMPALT and the PMPS. Forty-eight (50 percent) of the subjects were found to have a dominant strength (revised MMPALT) in the visual style; however, five of the six remaining styles were still measured as the primary styles of other subjects. In fact, 17 different single dominant or multiple dominant styles were found on the revised MMPALT assessments.

In summary, the adults tested demonstrated variability in both measured style and preferred style on six of the seven

elements. The olfactory element did not receive primary or secondary ranking for any subject on either measurement device.

IV. LEARNING STYLE PATTERNS WITHIN SUBJECT GROUPINGS

This section uses data drawn from the Tables in Appendix F, and it is divided into two parts. First, the measured findings of group style dominance are reported under the heading Grouped Revised MMPALT Results. Second, the expressed preferences of learning style are reported under the heading Grouped PMPS Results. Data from all 23 subject groups in the total subject population were analyzed and produced these findings.

Grouped Revised MMPALT Results

1. Revised MMPALT scores revealed the primary style of learning to be visual in all learning groups.

2. In 20 of the 23 subject groupings, the haptic was measured as a secondary style of learning.

3. In the "Jail" and "Age 30-34" groupings, the aural was identified as a secondary style of learning.

4. In the "Leadership School" grouping, the interactive was the secondary style of learning.

5. Across the total population, the visual element ranked highest (primary style) and the haptic element ranked second (secondary style).

Grouped PMPS Results

1. The most frequently chosen primary style of learning

was kinesthetic (13 of the 23 groupings).

2. Six subject groupings expressed a preference for the visual learning style. Those 6 were: those who completed the revised MMPALT measurements before responding to the PMPS, females, those with some college, those with 16 or more years formal education, age grouping 20-29 years, and age grouping 35-39 years.

3. Four groups selected interactive as their primary learning style. Those groupings were: the test group, educational colleagues, age grouping 40-44 years, and age grouping 45-68 years.

4. The most frequently chosen secondary style of learning was visual (10 of the 23 groupings).

5. Nine groups selected interactive as their secondary learning style preference.

6. The kinesthetic and print learning styles were chosen as secondary preferences by three groups and one group respectively.

7. The total subject population recorded a preference for kinesthetic as a primary style and visual as a secondary style. It should be noted, however, that the tertiary, preference, interactive, was rated almost as high as visual (See Figure 2).

Summary

Individually and collectively, the most frequently measured primary style was visual and the second most frequently

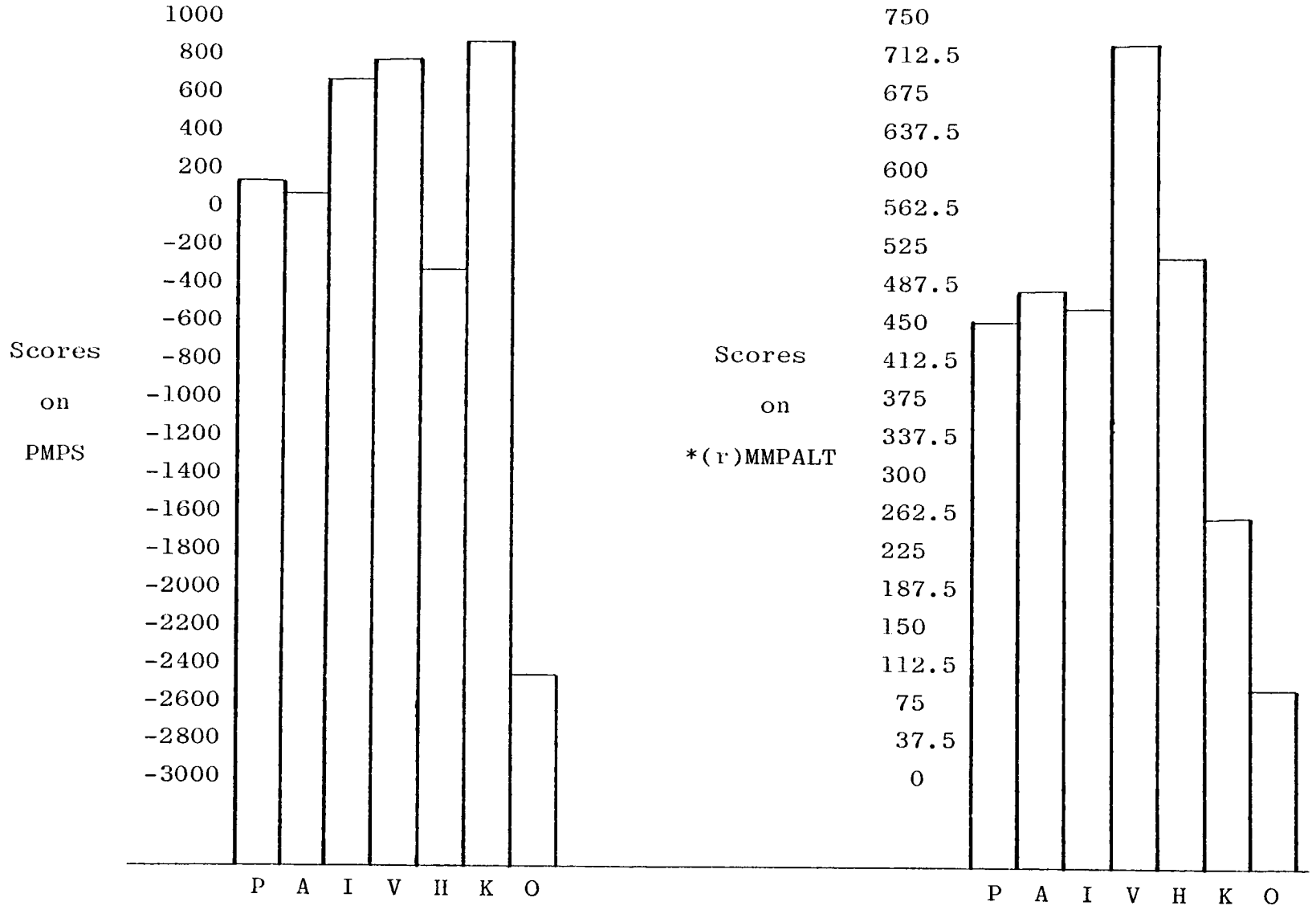

Figure 2. Relative Total Scores for Subject Population

*revised

measured strength was haptic. Individually and collectively, the most frequently expressed preferences were kinesthetic, visual, and interactive.

Figure 2, page 83, constructed from the total scores of the total population, shows the relationship of measured strengths to expressed preferences. It can be seen that three PMPS style elements (kinesthetic, visual, and interactive) were scored with approximately the same strength as the highest revised MMPALT element (visual). It can also be observed that the two olfactory scores were virtually equal in strength.

V. GROUP PATTERNS COMPARED TO GILLEY'S FINDINGS

Gilley reported the primary style, secondary style, and style rank-orders in third grade children. Using subject scores on standardized tests, Gilley reported rank-orders in two subject categories, high achievers and low achievers. Gilley concluded:

> Over all [sic], the most efficient means of inputing information to both high achievers and low achievers was the haptic mode (p. 79).
>
> Over all [sic], the second most efficient means of inputing information to both high achievers and low achievers was the visual mode (p. 80).
>
> The hierarchical alignment of preferred information input modes for high achievers was:
>
> 1. Haptic
> 2. Visual
> 3. Aural
> 4. Print
> 5. Kinesthetic
> 6. Interactive

The hierarchical alignment of preferred information input modes for low achievers was:

1. Haptic
2. Visual
3. Kinesthetic
4. Aural
5. Interactive
6. Print (p. 80).

Gilley did not measure the olfactory style element, and all subject group measurements in this study had the olfactory element ranked last. Therefore, the olfactory element was not included in this comparison.

Table VI compares findings of the two studies. The table contains rank-orderings of the two child groups measured by Gilley and three adult groups from this study. The 3 adult groups reported are: the total population, those with less than 12 years formal education, and those with 16 or more years of formal education. The latter two groups were chosen because they best represent the high achievers and low achievers in this adult population. (See definition of achievement in Chapter I.)

Initially, this comparison indicates a direct reversal in the primary and secondary styles of the adults in this study and Gilley's child population. Gilley's subjects demonstrated a haptic primary style and a visual secondary style. The adults in this study demonstrated a visual primary style and a haptic secondary style. This is consistent with previously cited research and receives additional discussion in Chapter V.

The second part of this comparison included the

TABLE VI

COMPARISON OF RANK-ORDER FINDINGS BETWEEN
GILLEY'S THIRD GRADE LEARNERS AND
THIS STUDY'S ADULT LEARNERS

	Style Element Rank-Orders						Correlation to Gilley's	
	Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	High Achievers	Low Achievers
This Study's Adults:								
Total Population	5	3	4	1	2	6	.77	.60
Education Under 12 Years	4	3	5	1	2	6	.89	.54
Education of 16 Or More Years	3	5	4	1	2	6	.66	.37
Gilley's Third Grade:								
High Achievers	4	3	6	2	1	5	1.00	.71
Low Achievers	6	4	5	2	1	3	.71	1.00

calculation of six Spearman rank-order correlation coefficients, and evaluation of those correlations against the Best (1959) correlation categories. Correlations were calculated for each of the three adult groupings compared to each of Gilley's groupings. An evaluation of the rank-orders and correlations (Table VI, page 86) yields the following facts:

1. The correlation between Gilley's high achievers and the adults with under 12 years education was .89; Best classifies this as high to very high. The two groups also demonstrated a reversal of the two lowest ranked styles, interactive and kinesthetic. It should be noted that the correlation between these two groups was the highest (.89) of the group comparisons.

2. The second highest correlation of .77 was between Gilley's high achievers and the total population of adults in this study. Best classifies this correlation as substantial or marked.

3. The third highest correlation also included Gilley's high achievers. Their rank-orders were correlated with the adult high achievers, 16 or more years of education, at .66. This level is also classified as substantial or marked on the Best scale.

4. The three lowest correlations involved Gilley's low achiever group. That group compared to the total adult population at .60 and the adults with less than 12 years education at .54. Best classifies both of those correlations as moderate.

The correlation for Gilley's low achievers and adults with 16 or more years education was .37. Best classifies this correlation as low or slight.

Summary

The visual and haptic perceptual styles were the highest ranked styles in both studies, but their primary and secondary positions were reversed. Additionally, the kinesthetic and interactive styles were the lowest ranked common styles in both studies; they too were reversed. There was a high level of correlation (.89) between Gilley's high achievers and this study's lower achievers (under 12 years of formal education). The lowest level of correlation (.37) was between Gilley's low achievers and this study's high achievers (16 or more years of formal education).

VI. RANK-ORDER CORRELATIONS

The measurement of individual learning styles provides an opportunity for teachers to optimize student learning by basing instruction on individual student strengths. The effectiveness of reaching that end is directly related to the predictive ability or accuracy of the measurement instrument. The issue of student preferences in learning style compared to actual learning style strengths is a major concern in learning styles measurement. Therefore, this section examines the correlations between the revised MMPALT and PMPS rank-orders for the various subjects and the various subject groupings.

The Best (1959) categories of correlation coefficient relationship provide the basis for examining the accuracy of the PMPS as a predictive instrument. Those categories are:

Coefficient	Relationship
00 to ± .20	negligible
±.20 to ± .40	low or slight
±.40 to ± .60	moderate
±.60 to ± .80	substantial or marked
±.80 to ±1.00	high to very high (Best, 1959, p. 240).

As may be noted, the Best categories overlap at the .20, .40, .60, and .80 coefficients. Correlations at those exact coefficients are reported at the lower, more conservative, category to increase the validity of conclusions drawn from the data.

The Best categories of correlations are reported for the 96 individual subjects and the 23 subject groupings. Correlation results were apparently influenced by the order of test and survey administration; therefore, individual subject data are reported by identifying those who completed the PMPS either before or after participating in the revised MMPALT measurements.

Table VII summarizes the correlations for the 96 individual subjects. An examination of that table yields the following facts:

1. Only seven subjects (seven percent) demonstrated high to very high correlations between rank-orderings of their responses to the PMPS and their performance on the revised MMPALT. All of those subjects had benefit of completing the

TABLE VII

CORRELATION CATEGORIES FOR INDIVIDUAL SUBJECTS

Correlation Category	Correlation	Number of Subjects taking: *(r)MMPALT Before PMPS	PMPS Before *(r)MMPALT
High to Very High			
	.99	1	
	.93	1	
	.92	1	
	.90	1	
	.88	1	
	.82	1	
	.81	1	
		7	0
Substantial or Marked			
	.80	1	
	.78	1	
	.77		2
	.75	1	1
	.72	1	
	.71	1	1
	.67	1	
	.65	1	
	.64		1
	.63	1	
	.62	2	
		10	5
Moderate			
	.60		1
	.59		1
	.58		1
	.56	2	1
	.53		1
	.52	1	2
	.50		1
	.48		1
	.47		2
	.45	1	
	.44	2	1
	.42	1	
	.41	1	
		8	12

*revised

TABLE VII (Continued)

Correlation Category	Correlation	Number of Subjects taking: *(r)MMPALT Before PMPS	PMPS Before *(r)MMPALT
Low or Slight			
	.40		1
	.39	1	1
	.38	2	
	.37	1	
	.36	1	1
	.29	2	1
	.28		1
	.27	1	1
	.24	1	1
	.23	1	
		10	7
Negligible			
	.17	1	1
	.16		2
	.15	1	1
	.13	1	
	.12	2	
	.11		3
	.09		1
	.07		2
	.06	2	
	.05	1	
	.02		1
		8	11
Negative			
	.00		2
	-.01		1
	-.02		1
	-.04		1
	-.07	1	
	-.13		2
	-.15	1	1
	-.17		1
	-.18	1	
	-.22		1
	-.23		1
	-.25	1	1
	-.38		1
	-.56	1	
		5	13

*revised

revised MMPALT before responding to the PMPS questionnaire.

2. Only fifteen subjects (16 percent) demonstrated a substantial or marked correlation between rank-orderings of their responses to the PMPS and their performance on the revised MMPALT. Ten of those subjects had benefit of completeing the revised MMPALT before responding to the PMPS questionnaire. Therefore, only five subjects (five percent who were not influenced by prior experience with the revised MMPALT demonstrated preferred learning approaches which matched their actual strengths in a substantial or marked fashion.

3. Fifty-five subjects (57 percent) demonstrated low, slight, negligible, or negative correlations between the 2 rank-orders.

In summary, it can be concluded that there were no meaningful correlations between the PMPS and revised MMPALT rank-orders for individual subjects.

Table VIII summarizes the correlations for the 23 subject groupings. An examination of that table yields the following facts:

1. None of the subject groupings demonstrated correlations in either of the top two categories.

2. Twenty-one of the 23 subject groupings (91 percent) demonstrated low, slight, negligible, or negative correlations between the two rank-orders.

3. The 16 or more years of formal education group demonstrated the highest correlation (.57) between the PMPS

TABLE VIII

CORRELATION CATEGORIES FOR SUBJECT GROUPINGS

Correlation Category	Correlation	Subject Group and Number of Subjects
High to Very High		
		None
Substantial or Marked		
		None
Moderate		
	.57	16 or more years of Education (25)
	.46	Age 40-44 years (15)
Low or Slight		
	.39	Educational Colleagues (19)
	.39	Females (20)
	.39	RMMPALT before PMPS (43)
	.38	Test Group (10)
	.36	Age 35-39 years (21)
	.35	Age 45-68 years (11)
	.32	Age 25-29 years (22)
	.32	Some College (38)
	.32	12 years of Education (22)
	.29	NCO Academy (34)
	.21	PME Center (60)
Negligible		
	.18	Age 30-34 years (11)
	.18	Leadership School (6)
	.14	Academy of Military Science (20)
	.14	Males (76)
	.14	PMPS before RMMPALT (43)
	.14	Total Subject Population (96)
	.07	Age 19-24 years (16)
	.07	Jail (7)
Negative		
	-.02	Adult Basic Education (9)
	-.07	Under 12 years of Education (11)

and revised MMPALT rank-orders, and the lowest correlation (-.07) was for the under 12 years of education group. Additionally, there is an increase in correlation as level of education increases in the various groups.

4. Females demonstrated a higher correlation than did males.

5. Within age groupings, the 40-44 years group demonstrated the highest correlation (.46), and the 19-24 years group demonstrated the lowest correlation (.07). The other groupings were generally mixed.

6. Prior experience with the revised MMPALT did appear to increase the probability of higher correlations.

In summary, it can be concluded that there were no meaningful correlations between the PMPS and revised MMPALT rank-orders for the subject groupings.

VII. SUMMARY

The various revised MMPALT and PMPS data were summarized into tables (Appendices F and G), and information was extracted from those tables to address the several study questions. Those questions provided the criteria for a simple summative analysis of data and the organization of this chapter.

The existence of French's learning styles in an adult population was examined by comparing this study's score and rank-order ranges with Gilley's findings. A strong similarity did exist between the findings of the two studies.

Score ranges and highest ranked styles from both the revised MMPALT and PMPS were examined to confirm or deny the existence of measurable variability in adult learning styles. A large portion of the population demonstrated a measured strength towards the visual style; however, the total population did demonstrate variations in both measured strengths and selected preferences in learning style.

The question of dominant group patterns was addressed by examining both measured (revised MMPALT) and preferred (PMPS) group learning styles. A few groups demonstrated unique dominance in several styles; however, most groups were measured to have a visual/haptic dominance, and their surveys indicated a kinesthetic/visual/interactive dominance.

The measured strength rank-orders from this study were compared to Gilley's rank-order findings to compare and contrast adult learning styles found in the adult population under investigation with the learning styles found by Gilley in children. All variations are apparently attributal to the differences in age, ability, and maturity. These findings are consistent with other research, and they will receive additional discussion in Chapter V.

A major focus of this study was the measurement of preferred learning styles compared to the measurement of actual learning strengths. Correlations between the PMPS and revised MMPALT rank-order findings were virtually non-existent; however, educational level and prior experience with learning styles

measurement apparently influence correlations between perceived learning style and actual learning style strengths.

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS

I. PURPOSE

This research focused on the measurement of adult learning styles. To improve student learning through individualization of instruction, adult educators must first discover what differences exist within each learner. As researchers move toward an effective and efficient system for measuring adult learning styles, adult educators are brought closer to a valuable tool for individualizing adult education.

Previously Gilley offered proof of the existence of six perceptual learning styles in third grade children. Additionally, he developed an instrument to measure the relative strengths of learners in each of those styles. French, however, had originally conceptualized the existence of seven perceptual styles in learners of all ages. This study was designed to further refine the Gilley measurement instrument, adapt that instrument to an adult population, and examine the validity of French's conceptualization of seven styles in an adult population.

Additionally, this study examined the relationship between two approaches used in identifying individual learning style. Some assessment procedures use self-report instruments to focus on student preferences. Others attempt to measure actual strengths (dominances) of one or more learning styles in

the student empirically. Several researchers are currently using efficient survey techniques to determine student preferences in learning style, but the validity of these self-reports has been questioned. Therefore, this study examined the relationship between self-assessments of learning style and empirical measurements of learning style strengths.

II. PROCEDURES

Two measurement instruments were prepared for use in this study. The first was a revision of Gilley's Multi-Modal Paired Associates Learning Test (MMPALT). This instrument was used to determine each subject's relative strengths in seven perceptual learning styles. The second instrument was a questionnaire used to identify each subject's relative preferences for each of the same seven styles. Identified as the Perceptual Modality Preference Survey (PMPS), the questionnaire was developed specifically for this research.

Volunteer subjects were secured in order to produce a study population consisting of adult learners with a variety of educational and geographic backgrounds. The final subject population consisted of 96 adults from a variety of educational programs and 31 states. They ranged in age from 18 to 68 years. Their formal education ranged from eighth grade to bachelors and advanced degrees. Volunteers were used because adult learners are generally self-directed when entering educational activities, and because the focus of investigation was the

measurement of learning style within individuals rather than adults in general.

The measurement procedures required each subject to complete the seven part revised MMPALT and the PMPS questionnaire. To compensate for first-test, second-test interaction bias in the final statistics, half (48) of the subjects completed the revised MMPALT before replying to the PMPS questions, and half (48) completed the revised MMPALT after completing the PMPS.

Measurement data were transferred to machine processable score sheets, and all data were computer processed. The final computer products were transferred to summary tables (Appendices F and G), and those tables were used to address each study question. Simple summations of individual subject scores and rank-orders were used to address the study questions.

III. FINDINGS

The five study questions were addressed by: (1) comparing the revised MMPALT score and rank-order ranges to similar data found in Gilley's study, (2) identifying the degree of learning style variability demonstrated by the subjects on both the revised MMPALT and the PMPS, (3) determining identifiable patterns of learning styles for the various subject groups as reported on both the revised MMPALT and the PMPS, (4) comparing the revised MMPALT group patterns to Gilley's findings, and (5) evaluating the correlations between revised MMPALT and PMPS rank-orders of both individual and grouped subjects.

Score and Rank-Order Ranges Compared to Gilley's Findings

Gilley (1975) concluded that individuals received and process information differently; no two children had exactly the same hierarchical alignment of styles (p. 80).

In this study, only two of the 96 subjects had the same revised MMPALT rank-ordering of styles, and those subjects had different scores on the various elements. In fact, no two subjects had identical scores or score patterns.

A comparison of rank-order ranges (Table II, page 74) revealed a strong similarity between revised MMPALT findings and Gilley's earlier findings. Any lack of similarity was attributable to: (1) the addition of the olfactory element to the measurements and (2) the difference in population size.

Learning Style Variability

The subjects demonstrated measurable variations in both actual learning style and preferred learning style. They used 90 percent of the possible revised MMPALT score range, and 74 percent of the possible PMPS score range. A total of 17 different single or multiple dominant styles were measured on the revised MMPALT, and 8 different dominant preferences were discovered on the PMPS.

Identifiable Group Patterns

Clear patterns of actual learning styles and preferred learning styles were found in the various subject groups. All groups, including the total population, demonstrated empirically

a dominance in the visual style. The second strongest style was haptic. The most dominant style preference was kinesthetic; however, two other styles, visual and interactive, received very high preference ratings.

The olfactory style consistently scored as the weakest (empirical test) and least preferred style (self-report).

Study Findings Compared to Gilley's Findings in Children

Both of Gilley's sub-groups, high achievers and low achievers, demonstrated their greatest strength in the haptic style, and their second greatest strength was visual. This study's adult population demonstrated their greatest strengths in the same two styles, but in reverse order.

When considering all six styles measured by Gilley, the highest correlation (.89) was between this study's adults with under 12 years formal education and Gilley's high achievers. These two groups also demonstrated a reversal of their two lowest ranked styles. Among children the kinesthetic and interactive styles ranked fifth and sixth, respectively. Among the adults measured with the revised MMPALT, those two styles occupied reverse positions in rank.

Correlation between this study's total population and Gilley's high achievers was .77. Revised MMPALT rank-orders of adults with 16 or more years of formal education and Gilley's high achievers correlated at the .66 level.

Rank-order correlations between Gilley's low achievers and this study's adult groups were all classified as low or

slight (Best, 1959). The lowest correlation (.37) was between adults with 16 or more years of formal education and Gilley's low achievers.

Revised MMPALT and PMPS Rank-Order Correlations

There were no meaningful correlations between revised MMPALT and PMPS rank-orders. Only seven individuals demonstrated high (Best, 1959) correlations, and those subjects had benefit of completing the revised MMPALT measurements before responding to the PMPS questionnaire. Only 15 subjects demonstrated substantial or marked (Best, 1959) correlations; 10 of those subjects completed the revised MMPALT before responding to the PMPS questionnaire. None of the subject groups demonstrated high rank-order correlations.

IV. CONCLUSIONS

In the context of this study's population, the first three study questions are answered in the affirmative; for the fourth, valid comparisons are reported; the fifth is answered in the negative.

Do the seven perceptual styles identified by French manifest themselves in adults?

This question is answered in the affirmative because all seven styles were measurable within these subjects, and measurement ranges were found to be similar to those found by Gilley. One of the seven elements, olfactory, was not measured

by Gilley and it was the weakest of the seven styles for these adults however, it was still found to be measurable. It can be concluded that the adults under investigation in this study did possess measurable perceptual learning styles.

Are there measurable variations in the perceptual learning styles of adults?

This question is answered in the affirmative because the scores of subjects on both the revised MMPALT and PMPS were widely distributed across the statistically possible range. Additionally, primary, secondary, and multiple primary styles differed widely among the subjects. Even the olfactory style received a substantial spread of scores; however it was not scored as one of the primary, secondary, or multiple primary styles by any subject. Again, it was found that the olfactory style ranked lowest of the seven styles among the adults measured. It can be concluded that the adults investigated in this study varied in their perceptual learning styles.

Are there dominant identifiable patterns of perceptual style within/across various groups of adult learners?

This question is answered in the affirmative because the adults in this study demonstrated clearly dominant patterns of both actual and preferred learning styles. These adults expressed a primary preference for the kinesthetic style; the visual and interactive styles also received high preference ratings. But the actual styles of those adults were found to

be predominantly visual and haptic. In fact, as a group, the adult subjects demonstrated a clear dominance in the visual style with the haptic occupying second place. It can be concluded that dominant identifiable patterns of perceptual style were manifested in this sample of adult learners.

It should be noted, however, that the above conclusion can not be generalized to all adult learners or all learning situations. Each group contained individual subjects who did not share the group strength, and three groups were identified with secondary styles other than haptic. In the "Jail" and "Age 30-34" groups, aural was identified as the secondary style of learning; in the "leadership school" group, interactive was identified as the secondary style of learning. It is, therefore, further concluded that learning style variations can be expected in all learning populations.

How do the measurements of perceptual styles in adults compare/contrast with the measurements conducted earlier by Gilley in children?

Valid comparisons were found to exist between some adult group styles and Gilley's groups. Additionally, comparisons led to other conclusions.

An attempt was made to approximate Gilley's high achiever and low achiever groupings in this adult population. Gilley used standardized achievement test results to establish his groups. It was assumed that years of formal education in an adult population was an equitable indicator of achievement.

Therefore, adults with under 12 years of formal education were considered to be "low achievers," and adults with 16 or more years of formal education were considered to be "high achievers." Used in this context, achievement is broadly defined to include experience, degree of self-direction and self-discipline, and general level of maturity.

High achieving children might be expected to be more broadly experienced, more self-directed, more self-disciplined, and more mature than low achieving children. Low achieving adults might be expected to possess levels of experience, self-direction, self-discipline, and maturity which are less than those possessed by high achieving adults. It is, therefore, assumed that Gilley's high achieving children are more closely aligned with this study's low achieving adults than they are to this study's high achieving adults. It is also assumed that the widest development gap is between the low achieving children and the high achieving adults.

The highest level of correlation (.89) was between Gilley's high achievers and this study's low achievers. Additionally, the level of correlation decreased as the developmental gap widened. In fact, the lowest level of correlation (.37) was between Gilley's low achievers and this study's high achievers. It is, therefore, concluded that there was in this population a relationship between individual learning style and the learner's "achievement" level.

The above conclusion is also related to the style

reversals found in this study and previous research findings. As cited in Chapter II, Barbe and Milone, Keefe, and Dunn and Dunn have all reported a trend away from the aural, tactile, or kinesthetic styles and towards the visual style as learners mature. Additionally, Lowenfeld has concluded that adults are primarily (47 percent) visual in their learning styles. When results of this study are compared to Gilley's findings, a similar trend is indicated. The findings of this and other studies might suggest that the relative strengths of the various perceptual styles are influenced by increasing age, maturity and achievement. Indeed, these factors may influence visual style toward a more dominant position and the haptic and kinesthetic styles toward less dominant ones. However, firm conclusions cannot be drawn without longitudinal study of these trends and factors. It can be concluded; however, that perceptual style patterns found in the adults investigated in this study compared in many ways to the patterns found by Gilley in children.

Do adult learner self-assessments of their perceptual modalities of learning style show positive correlation with empirical measurements of the same styles?

This question is answered in the negative because correlations of PMPS and revised MMPALT rank-orders for more than half of the individuals measured were low or slight, and correlation between rank-orders for the total group was negligible (.14) (Best, 1959).

Based on the limited sample of subjects in this investigation one might conclude that self-assessment of one's learning style often does not provide valid information about the individual's style. However, it should be noted that levels of correlation increased as higher levels of formal education were reported and subjects were exposed to the revised MMPALT measurements before responding to the PMPS questionnaire. These two factors, years of formal education and knowledge of learning styles concepts, seem to strengthen the correlation between one's perception of his/her learning style and his/her actual learning style. Ultimately it can be concluded that the self-assessments of perceptual style by adults in this study correlated only slightly with empirical measurements of these same styles.

V. RECOMMENDATIONS

Within the constraints of this limited study general recommendations for future research and improved teaching are presented.

Future Research

The ideal measurement instrument is both efficient (economical, quick, easy to administer) and effective (valid), reliable). Self-report instruments tend to be time and cost efficient, but their effectiveness is often questionable. The original MMPALT was effective, but it was costly in both time and money. The revised MMPALT improved on the efficiency of

the measurement procedures, but more refinements can be made. It is, therefore, recommended that future modifications of the MMPALT include considerations of greater efficiency without sacrificing effectiveness. These modifications should include procedures for additional group measurements (interactive, haptic, kinesthetic, or olfactory), procedures for subject self-measurements (e.g., scratch and sniff cards for olfactory measurements), or fully automated group measurement systems (e.g., video taped print, aural, and visual measurements).

Additionally, efforts should be made to develop effective self-report measurement systems. This appears to be an extremely difficult task; however, the findings of increased correlation with increased education and exposure to learning styles concepts offers one possible approach. The validity and reliability of self-report instruments might be increased by exposing the subjects to an extensive training program before completing the surveys. Attention to types of questions used in self-reporting offers another avenue of refinement. More will be said about this under Implications and Discussion.

Research into the measurement of other modalities and elements and relationships between modalities and elements is also recommended. Previously (Chapter II) it was suggested that at least three other learning style modalities exist (cognitive, emotional, and social). Each of those modalities probably contains its own set of elements, and elements may appear in more than one modality. For example, the interactive

element might be included in the emotional and social modality as well as the perceptual modality. Therefore, it would appear that research into the interrelationship of modalities and elements is justified.

One element, olfactory, was added to the original MMPALT for this study. That style was found to be generally weak in this adult population, but that does not preclude it as a strong style in another population or even in a broader spectrum of adult learners. Therefore, it is recommended that olfactory measurements be conducted with additional populations. Specifically, studies with children, cooking school students, or students from foreign cultures are recommended. Age, vocational interests, cultural background or other factors may contribute to olfactory dominance.

This study's findings of a large number of visual learners might be related to recent research into brain hemispheres. This related area of research has associated verbal and visual behavior to the left and right hemispheres. Therefore, research into the relationship between perceptual learning style and hemisphere dominance is recommended.

Obviously, the research with adults should be extended to a much larger population. The limited numbers and types of subjects in this study precluded generalization to adults in general or to recognizable sub-groups within the adult population.

Teaching and Individualized Instruction

A major element of this research was an examination of the relationship between subject self-reports of individual learning style and empirical measurements of those styles. Self-reports apparently identify learning style preferences, but they do not validly identify actual learning strengths. Individualization of instruction based on student preferences may have aesthetic value, but it may not necessarily enhance learning. This investigator would recommend that self-report measurements of learning style be used with extreme caution in adjusting instruction.

As reported in Chapter II, page 20, McKinney believes that individuals develop both conscious strategies and unconscious habits for acquiring information through the senses. One's perceptual learning style (perceived or actual) influences and is influenced by one's conscious strategies and unconscious habits for acquiring information through the senses. Habits or strategies governed by false perceptions may produce poor results; habits or strategies guided by a knowledge of actual strengths and weaknesses can produce improved performance. Therefore, valid measurement of actual learning style strengths is extremely important to any proposed adjustments of instructional or learning activity. It is recommended that instructional adjustments be based on validated measurements of actual learning style.

It is also recommended that students receive instruction

in the concepts of individual learning style. Penland (1978) has reported that modern adult learners want to control the pace and character of their own learning. This training will provide a foundation for the student to develop conscious strategies for acquiring new information from his or her environment. As this study found, the correlation between preferred and actual style increased as the subjects gained knowledge of learning style concepts.

VI. IMPLICATIONS AND DISCUSSION

Major implications of this study relate to both measurements of individual learning styles and instruction based on those measurements.

This study clearly raises again the discussion of self-report versus empirical instrumentation in the measurement of learning style. Two facets of this discussion should be considered.

First, it must be recognized that self-report instruments (questionnaires, surveys) currently available provide information about individual preferences. The validity of these data is affected by the type of questions asked. Two methods of question presentation are used in collecting information about the habits and preferences of human beings. One method calls upon the individual to report how he/she does or prefers to do something. In the other method, the individual is asked to report the steps or processes he/she uses to complete a task.

Obviously, the first method of questioning generates information containing more (higher) inferences than the latter. If self-report data actually correlate to any real extent with empirical test data, the questioning procedures used in self-report instruments need great refinement in order to bring that correlation into focus. This study has not contributed greatly to resolution of that problem.

Second, the empirical measurement of actual learning style strengths requires a commitment of human and other resources which is greater than that required for administering surveys. Emphasis on learning styles assessment as a tool for instructional improvement will require that educational institutions be prepared to back their verbal commitments with monetary resources, time, and human effort.

The finding of dominant group patterns of perceptual style suggests implications for both group and individual instruction. Visual and haptic dominances were found across the various subject groups of this study, but not all individuals shared these dominances. If this trend is consistent in future studies, adult educators should be prepared to use instructional strategies rich in visual and haptic techniques without jeopardizing the learning of students with other style dominances. Teacher training programs should place emphasis on visual and haptic teaching strategies, but they should also prepare teachers to identify and react to a much broader range of individual differences.

Adult learners are generally self-motivated and

self-directed. They generally have the motivation to control the pace and character of their own learning, but they need guidance. Adult educators need the skills and tools to provide a valid diagnosis of each students' needs and each student's learning style uniquenesses.

Finally, the findings of this study emphasize again the fact that tools for measuring various modalities and elements of one's learning style can be developed and used to more fully individualize instruction for learners of all ages at all levels. However, educators at any level should not be misled into simplistic thinking. The relationship between diagnosis of the learner's style and instructional application may not be as simple as it seems.

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APPENDICES

APPENDIX A

LETTERS OF INVITATION AND INTRODUCTION TO LEARNING STYLES MEASUREMENT

September 1, 1980

TO: ALCOA Apprentices

FROM: Ed Cherry

Subject: Measurement of Individual Learning Styles

As part of my graduate studies at the University of Tennessee, I'm conducting measurements of individual learning styles. This project can be beneficial to both you and me. To complete my studies, I'll need to measure the learning styles of approximately 120 adults. The personal information which you can receive from this project can help you in your apprenticeship studies. Because of this potential benefit, The University of Tennessee, ALCOA, and the leadership of local 309 have authorized me to invite you to participate in this project.

Participation is voluntary, and I would not expect you to participate without specific information and certain guarantees. I've, therefore, enclosed an introduction to learning styles measurement and this project. Please read that introduction before making your decision.

Looking forward to your favorable decision, I've also enclosed a self addressed sign-up card.

Thank you for your time and consideration:

Ed Cherry

Ed Cherry

Approved:

Tim Garner

Tim Garner
President, Local 309

Dick Ray
ALCOA

September 1, 1980

TO: Adult Basic Education Students of Blount County

FROM: Ed Cherry

SUBJECT: Measurement of Individual Learning Styles

As part of my graduate studies at the University of Tennessee, I'm conducting measurements of individual learning styles. This project can be beneficial to both you and me. To complete my studies, I'll need to measure the learning styles of approximately 120 adults. The personal information which you receive from this project can help you in your ABE studies and future learning situations. Because of this mutual benefit, The University of Tennessee and the Blount County Adult programs supervisor have authorized me to invite you to participate in this project.

Participation is voluntary, and I would not expect you to get involved without specific information and certain guarantees. I've, therefore, enclosed an introduction to learning styles measurement and this project. Please read that introduction before making a decision.

Looking forward to your favorable decision, I've also enclosed a self addressed sign-up card.

Thank you for your time and consideration.

Ed Cherry

Ed Cherry

Approved:

B.A. Maner

Dr. B.A. Maner
Supervisor, Adult Programs

September 1, 1980

TO: State Prisoners, Blount County Jail

FROM: Ed Cherry

Subject: Measurement of Individual Learning Styles

As part of my graduate studies at the University of Tennessee, I'm conducting measurements of individual learning styles. This project can be beneficial to both you and me. To complete my studies, I'll need to measure the learning styles of approximately 120 adults. The personal information which you receive from this project can help you in your future learning and development. Because of this mutual benefit, The University of Tennessee and Sheriff Sutton have authorized me to invite you to participate in this project.

Participation is voluntary, and I would not expect you to get involved without specific information and certain guarantees. I've, therefore, enclosed an introduction to learning styles measurement and this project. Please read that introduction before making a decision.

Looking forward to your favorable decision, I've also enclosed a self addressed sign-up card.

Thank you for your time and consideration.

Ed Cherry

Ed Cherry

Approved:

L.B. Sutton
Sheriff

September 1, 1980

TO: ANG PMEC Students (20 Sept-11 Oct)

FROM: Ed Cherry

SUBJECT: Measurement of Individual Learning Styles

As part of my graduate studies at the University of Tennessee, I'm conducting measurements of individual learning styles. This project can be beneficial to both you and me. To complete my studies, I'll need to measure the learning styles of approximately 120 adults. The personal information which you receive from this project can help you in your PMEC and future studies. Because of this mutual benefit, The University of Tennessee and the Commander of the PMEC have authorized me to invite you to participate in this project.

Participation is voluntary, and I would not expect you to get involved without specific information and certain guarantees. Therefore, I've enclosed an introduction to learning styles measurement and this project. Please read that introduction before making a decision.

Looking forward to your favorable decision, I've also enclosed a self addressed sign-up card.

Thank you for your time and consideration:

Ed Cherry

Ed Cherry

Approved:

Edmond C. Morrisey, Col, ANG
Commander, PMEC

LEARNING STYLES MEASUREMENT

INTRODUCTION

What are learning styles, and why should we measure them?

As people are left handed or right handed they also have different ways of learning. Some learn best by reading, touching, seeing, or hearing; others learn best by talking with friends, actively doing things, or even smelling things. The measurement of learning styles is not a matter of finding good or bad, or determining pass or fail; it is a matter of discovering individual differences. When a student's style is measured, he or she can use the measurement results to plan and conduct his/her individual study programs.,

How will this measurement program be conducted?

After an explanation of the concept of learning styles and an introduction to the measurement procedures, each participant will receive seven practical measurements and complete a written survey. For the practical measurement, the participants will be asked to remember pairs of words, pictures, objects, smells, or movements. The number of pairs remembered will indicate the participant's strengths in each of seven learning styles: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. The written survey asks the participant's opinion on various methods for learning. A summary of those opinions indicates the participant's preferred method for learning.

When, where, and how long?

Two locations will be used, and individual measurements will be conducted between 8 AM and 5 PM on four consecutive Saturdays:

McGhee Tyson Airbase (Bldg. 202)
September 20th and October 11th

Local 309 Union Hall
September 27th and October 4th

It will take approximately three hours for each participant to complete the process. Individuals will be scheduled to start the activities at 8 AM, 10 AM, 12 noon, or 2 PM on the date of their choice. Each starting group will be limited to ten participants on a first signed-up, first scheduled basis.

Because this is part of a research project, the learning styles measurement will be conducted under a rigid set of rules:

1. Participation is on a voluntary basis and individuals may withdraw from the project at anytime.

2. Individual privacy will be fully protected

3. Published results will not identify individual participants.

4. No participant will be subjected to any physical, psychological, or social risk or injury.

For additional information or sign-up contact:

Ed Cherry
103 Ruskin Circle
Maryville
982-6253

SIGN-UP CARD

Ed Cherry

103 Ruskin Circle

Maryville, Tn 37801

FRONT

I have read the introduction to the learning styles measurement project, and I would like to be a participant in the project.

Check preferred date, place and time:

Sept 20th at Airbase	( )	8-11AM	( )
Sept 27th at Union Hall	( )	10AM-1PM	( )
Oct 4th at Union Hall	( )	12Noon-3PM	( )
Oct 11th at Airbase	( )	2PM-5PM	( )

Name:_____

Address:_____

_____

_____

Phone:_____

Signature:_____

REAR

APPENDIX B

ORGANIZATIONAL AND OPERATIONAL PROCEDURES FOR THE MEASUREMENT OF ADULT LEARNING STYLES: PERCEPTUAL MODALITY

ORGANIZATIONAL OUTLINE FOR CONDUCTING LARGE GROUP

LEARNING STYLES MEASUREMENTS

1. Establish three operating stations:

   Station A - Two evaluators introduce and demonstrate the measurement procedures.

   Station B - Use nine evaluators. Two evaluators assigned to conduct individual subject measurements in each of four Revised MMPALT elements: haptic, interactive, kinesthetic, and olfactory. One evaluator serves as coordinator to direct subjects to appropriate areas.

   Station C - Two evaluators administer the PMPS questionnaire and conduct three Revised MMPALT measurements: visual, aural, and print.

2. Organize subjects into groups of ten or less, and schedule the groups to begin the process at two hour intervals.

3. As each group begins at Station A:

   Explain measurement procedures and scheduling
   Demonstrate each area of the Revised MMPALT measurement
   Answer subject questions
   Divide original group into groups of five
   Send five subjects to Station B and five to Station C

4. When the subjects have completed the procedures at their respective stations, have them swap places to complete the measurements.

STATION A

Requirements:

People: Two trained evaluators

Equipment:
- Two 35MM slide projectors
- Introductory slide sets
- Screen
- Tape recorder/player
- Introductory tape
- Wooden block and baseball for haptic demonstration
- Two vials for olfactory demonstration
- Blindfold
- Introductory outlines and script

Procedures:

1. Welcome subjects and introduce self.
2. Introduce concept of learning styles (see outline).
3. Explain and demonstrate measurement procedures (see outline and script).
4. Divide subjects into two smaller groups.
5. Send even numbered subjects to Station B.
6. Send odd numbered subjects to Station C.

Outlines and script:

OUTLINE FOR INTRODUCING THE CONCEPT OF LEARNING STYLES

NOTE: The purpose of this introduction is to stimulate each subject's interest and enthusiasm towards learning more about their own individual uniqueness as a learner. Therefore, do not use excessive detail, and adjust presentation to the subjects apparent needs.

1. Develop the following points.

   - Each person in the world is different from all others.

   - One of the differences in each of us is how we learn.

   - Those differences might be in how we receive, process, store, retrieve, or use new knowledge or information.

   - One concept of how we receive knowledge and information includes seven learning styles

     (Briefly explain each):

     Print
     Aural
     Interactive
     Visual
     Haptic
     Kinesthetic
     Olfactory

   - Each person should learn more about their own learning style.

     By using our best style we can learn better.

     By knowing our weaknesses we can improve on them.

2. Allow and encourage subject questions and discussion.

3. Proceed to measurement procedures introduction.

OUTLINE AND SCRIPT FOR INTRODUCING THE LEARNING STYLES MEASUREMENT PROCEDURES

1. Explain the measurement procedures (use script)

YOU ARE ABOUT TO BE MEASURED TO DETERMINE YOUR STRONGEST LEARNING STYLE OR STYLES. THIS MEASUREMENT PROCESS WILL SERVE TWO PURPOSES. FIRST, YOU WILL RECEIVE A REPORT IDENTIFYING YOUR STRENGTHS AND WEAKNESSES AS A LEARNER. THIS CAN HELP YOU IN YOUR FUTURE LEARNING ENDEAVORS. SECONDLY, THE RESULTS OF THIS TESTING WILL BE USED TO SUPPORT AN EDUCATIONAL RESEARCH PROJECT. THEREFORE, EACH OF YOU WILL HAVE AN OPPORTUNITY TO CONTRIBUTE TOWARDS IMPROVING LEARNING AND SCHOOLING FOR OTHERS.

SINCE THE DATA FROM YOUR MEASUREMENTS WILL BE USED A RESEARCH REPORT, YOU HAVE BEEN ASKED TO SIGN A RELEASE FORM. IT SHOULD BE NOTED, HOWEVER, THAT ALL PERSONAL IDENTIFICATION WILL BE REMOVED FROM THE MEASUREMENT RESULTS. YOU HAVE BEEN ASSIGNED CODE NUMBERS, AND THOSE NUMBERS WILL BE USED ON ALL MEASUREMENT REPORTS.

THE ACTUAL MEASUREMENTS WILL BE CONDUCTED AT TWO DIFFERENT AREAS CALLED STATIONS. AFTER THIS INTRODUCTION, YOU WILL BE DIVIDED INTO TWO GROUPS. ONE GROUP WILL GO TO STATION B LOCATED _____. THE SECOND GROUP WILL GO TO STATION C LOCATED _____. WHEN MEASUREMENTS ARE COMPLETED AT EACH STATION, APPROXIMATELY ONE HOUR, THE TWO GROUPS WILL SWAP STATIONS TO COMPLETE THE PROCESS. AFTER COMPLETING ALL MEASUREMENTS, EACH OF YOU WILL HAVE AN OPPORTUNITY TO DISCUSS YOUR RESULTS WITH THE PROJECT DIRECTOR.

STATION B PROCEDURES WILL CONSIST OF FOUR PRACTICAL MEASUREMENTS. STATION C PROCEDURES WILL CONSIST OF THREE PRACTICAL MEASUREMENTS AND A WRITTEN SURVEY OF YOUR THOUGHTS ABOUT YOUR LEARNING STYLE. TO PREPARE YOU FOR EACH AREA OF THE MEASUREMENTS, WE WILL EXPLAIN AND DEMONSTRATE EACH OF THE MEASUREMENT PROCESSES.

THE WRITTEN SURVEY OF LEARNING STYLES CONSISTS OF FORTY-TWO STATEMENTS. YOU ARE TO READ EACH STATEMENT AND DECIDE HOW THAT STATEMENT APPLIES TO YOUR STYLE OF LEARNING. YOUR RESPONSE CHOICES ARE: ALWAYS, USUALLY, SELDOM, OR NEVER. YOU MAY CONSIDER YOUR PAST EXPERIENCE IN LEARNING OR YOUR OWN INTUITION ABOUT YOUR STRENGTHS OR WEAKNESSES AS A LEARNER. IF THE STATEMENT STRIKES YOU AS A STRONG REPRESENTATION OF YOUR LEARNING STYLE, YOU SHOULD MARK THE "ALWAYS" RESPONSE. IF THE STATEMENT REPRESENTS A WAY YOU CAN LEARN WELL SOME OF THE TIME, "USUALLY" WILL BE THE BEST RESPONSE. IF THE STATEMENT INDICATES A WAY YOU CAN LEARN, BUT YOU WOULD PREFER ANOTHER METHOD, YOU SHOULD RESPOND BY MARKING "SELDOM." IF YOU BELIEVE THE STATEMENT REPRESENTS A LEARNING STYLE INAPPROPRIATE FOR YOU, "NEVER" IS THE PROPER RESPONSE.

IN ADDITION TO THE WRITTEN SURVEY YOU WILL RECEIVE THREE PRACTICAL MEASUREMENTS AT STATION C. ONE OF THOSE WILL IDENTIFY YOUR STRENGTHS AS A VISUAL LEARNER. FOR THAT MEASUREMENT, YOU WILL BE SHOWN TEN PAIRS OF PICTURES TO REMEMBER. AFTER YOU HAVE SEEN ALL TEN PAIRS, YOU WILL BE SHOWN ONE OF THE PICTURES FROM EACH PAIR AND ASKED TO IDENTIFY OR RECALL WHAT WAS PAIRED WITH THAT PICTURE. EXAMPLE (SHOW SLIDES): THE DIAGONAL LINE IS PAIRED WITH A PICTURE OF A TRUCK; WHEN YOU SEE THE DIAGONAL LINE AGAIN, YOU SHOULD RESPOND, AS MY ASSISTANT IS DOING, BY WRITING THE WORD "TRUCK" ON THE RESPONSE SHEET.

FOR THE AURAL LEARNING STYLE MEASUREMENT, YOU WILL BE BLINDFOLDED AND ASKED TO LISTEN TO A TAPE RECORDING CONTAINING PRESENTATIONS OF TEN NONSENSE WORDS PAIRED WITH TEN COMMON WORDS. (BLINDFOLD ASSISTANT AND PLAY SAMPLE TAPE CONTAINING "ROP" AND "CORN.") YOU WILL THEN REMOVE YOUR BLINDFOLDS, LISTEN TO ANOTHER RECORDING OF THE NONSENSE WORDS BEING PRESENTED IN A DIFFERENT ORDER, AND RESPOND BY WRITING THE CORRECTLY PAIRED COMMON WORD ON RESPONSE SHEETS (HAVE ASSISTANT DEMONSTRATE).

THE THIRD MEASUREMENT AT STATION C IS FOR THE PRINT LEARNING STYLE. FOR THIS MEASUREMENT, YOU WILL BE SHOWN TEN PAIRS OF WORDS. ONE WORD IN EACH PAIR IS A NONSENSE WORD, AND THE OTHER IS A COMMON WORD. (SHOW SLIDES) IN THIS PAIR "WUQ" IS PAIRED WITH THE COMMON WORD "ROBIN." AFTER YOU HAVE SEEN ALL TEN PAIRS, THE NONSENSE WORDS WILL BE PRESENTED TO YOU IN A DIFFERENT ORDER; YOU WILL RESPOND BY WRITING THE COMMON WORD ON THE RESPONSE SHEET, AS MY ASSISTANT IS NOW DOING.

STATION B INCLUDES FOUR INDIVIDUALLY CONDUCTED PRACTICAL MEASUREMENTS. FOR THE HAPTIC STYLE MEASUREMENT, YOU WILL BE BLINDFOLDED AND ALLOWED SEVERAL SECONDS TO HOLD, TOUCH, AND EXAMINE EACH OF TEN PAIRS OF ITEMS. (BLINDFOLD ASSISTANT AND PLACE THE ITEMS IN HIS OR HER HANDS.) AFTER HOLDING ALL TEN PAIRS, YOU WILL BE GIVEN ONE MEMBER OF EACH PAIR AND ALLOWED TEN SECONDS TO NAME OR DESCRIBE THE OTHER ITEM IN THAT PAIR. (DEMONSTRATE)

FOR THE INTERACTIVE MEASUREMENT YOU WILL DISCUSS PAIRS OF NONSENSE AND COMMON WORDS WITH AN EVALUATOR. THE EVALUATOR WILL PRONOUNCE THE WORD PAIRS AND ASK YOU TO REPEAT THE WORDS. (DEMONSTRATE WITH "YAG" AND "EYE.") YOU WILL BE GIVEN AN OPPORTUNITY TO BRIEFLY DISCUSS EACH PAIR. (DEMONSTRATE) AFTER DISCUSSING EACH OF THE TEN PAIRS, YOU WILL HEAR THE NONSENSE WORD SPOKEN AND BE ASKED TO STATE THE APPROPRIATE COMMON WORD. (DEMONSTRATE)

THE KINESTHETIC STYLE MEASUREMENT INVOLVES BODY MOVEMENT FROM A SPECIFIC STARTING POINT IN THE ROOM, YOU WILL BE GUIDED AND DIRECTED THROUGH PAIRS OF BODY MOVEMENTS WHILE BLINDFOLDED. (DEMONSTRATE WITH THE STOOP, HANDS UNDER KNEES STIMULUS MEMBER AND BOTH ARMS MAKING A SQUARE IN THE AIR RESPONSE MEMBER.)

AFTER GOING THROUGH ALL TEN PAIRS, YOUR EVALUATOR WILL AGAIN GUIDE AND DIRECT YOU THROUGH THE FIRST MOVEMENT OF EACH PAIR. YOU ARE TO RESPOND BY DEMONSTRATING OR DESCRIBING THE APPROPRIATELY PAIRED SECOND MOVEMENT. (DEMONSTRATE)

THE OLFACTORY MEASUREMENT INVOLVES THE SENSE OF SMELL. FOR THIS MEASUREMENT YOU WILL BE BLINDFOLDED AND PRESENTED WITH PAIRS OF SMALL VIALS CONTAINING DIFFERENT AROMAS. THE SECOND AROMA IN EACH PAIR WILL BE IDENTIFIED BY NAME TO ASSIST YOU IN REMEMBERING THE PAIRS OF SMELLS. (DEMONSTRATE) AFTER RECEIVING ALL TEN PAIRS OF SMELL VIALS, YOU WILL BE PRESENTED WITH THE FIRST SMELL IN EACH PAIR AND ASKED TO NAME THE AROMA IT WAS PAIRED WITH. (DEMONSTRATE)

2. Answer any questions that the subjects might have, and generally motivate the subjects to do their best on each area of the measurements.

3. Divide the group into two parts. Send the even numbered subjects to Station B; send the odd numbered subjects to Station C.

STATION B

Requirements:

People: Nine trained evaluators

one as coordinator
two for interactive measurements
two for haptic measurements
two for kinesthetic measurements
two for olfactory measurements

Equipment:

- Script and response sheets for interactive measurements
- Script, blindfold, materials box, and response sheets for haptic measurements
- Script, blindfold, and response sheets for kinesthetic measurements
- Script, blindfold, aroma vials, and response sheets for olfactory measurements
- Sign-up cards and initial report forms for coordinator

Procedures:

1. Coordinator greets subjects, obtains signatures on sign-up sheets, and sends subjects to Station A for introduction.
2. Coordinator receives subjects from Station A and directs them to the measurement areas.
3. Coordinator maintains a smooth flow of subjects through the various measurement areas.
4. All measurements are conducted according to scripts and procedures contained in the Revised MMPALT package.
5. Coordinator collects response sheets, posts scores on initial report forms, and sends subjects to Station C or project director as appropriate.

APPENDIX C

SCRIPTS AND PROCEDURES FOR THE REVISED MULTI-MODAL PAIRED ASSOCIATES LEARNING TEST

STATION C

Requirements:

People: Two trained evaluators (can be the same evaluators used at Station A when only one group is to be measured.)

Equipment:

- Two 35MM slide projectors
- Print and visual slide sets
- Screen
- Tape recorder/player
- Aural measurement tapes
- Five blindfolds
- Response sheets for print, aural, and visual measurements
- Scripts for print, aural, and visual measurements
- PMPS questionnaires
- PMPS response sheets and pencils

Procedures:

For subjects coming from Station A:

1. Have subjects complete PMPS questionnaire.
2. Conduct print, aural, and visual measurements according to script and procedures contained in the Revised MMPALT package.
3. Send subjects to Station B.

For subjects coming from Station B:

1. Conduct print, aural, and visual measurements according to script and procedures contained in the Revised MMPALT package.
2. Have subjects complete PMPS questionnaire.

3. Send subjects to Station B coordinator for initial report and meeting with project director.

PROCEDURES FOR MEASURING THE PRINT LEARNING STYLE

Equipment: Two 35MM slide projectors, slides, screen, response sheets, and pencils.

1. Place subjects approximately six feet from screen.
2. Distribute response sheets (face down) and pencils.
3. Display each stimulus member and response member pair at seven second intervals.
4. Have subjects pick up pencils and prepare to respond.
5. Announce number of response and display each stimulus member for ten seconds. e.g., "Number one (ten seconds), Number two (ten seconds), etc...."
6. Collect response sheets.

Pairings and sequence of stimulus/response pairs:

Stimulus Member:	Response Member:
biw	cat
ceq	party
puq	name
dup	bed
xib	box
cyc	horse
koy	rain
hez	sister
lez	paper
nyh	coat

Sequence for stimulus only display:

dup, cyc, koy, biw, xib, nyh, ceq, lez, puq, hez

PROCEDURES FOR MEASURING THE AURAL LEARNING STYLE

Equipment: Tape player, tapes, blindfolds, response sheets, and pencils.

1. Place subjects approximately six feet from player.
2. Have subjects put on the blindfolds.
3. Place response sheets and pencils in front of subjects.
4. Play tape recording containing stimulus/response pairs.
5. Have subjects remove blindfolds and prepare to respond.
6. Play tape recording containing stimulus words and response questions.
7. Collect response sheets.

Script and Instructions for tape:

FOR THIS EVALUATION, YOU WILL BE LISTENTING TO PAIRS OF WORDS. THE FIRST WORD IN EACH PAIR IS A NONSENSE WORD AND THE SECOND IS A COMMON WORD. YOU SHOULD TRY TO REMEMBER THE COMMON WORD IN EACH PAIR AND RECOGNIZE WHICH NONSENSE WORD IT GOES WITH. AFTER YOU HAVE BEEN GIVEN ALL TEN PAIRS OF WORDS, YOU WILL THEN HEAR EACH NONSENSE WORD AGAIN BUT IN A DIFFERENT ORDER. YOU ARE TO THEN WRITE THE COMMON WORD THAT IS APPROPRIATE FOR THE NONSENSE WORD. LET'S BEGIN.

(USE THE FOLLOWING STYLE TO PRESENT EACH PAIR.)

THE NONSENSE WORD IN THIS PAIR IS (STIMULUS): (STIMULUS) IS PAIRED WITH (RESPONSE). YOU ARE TO REMEMBER THAT STIMULUS GOES WITH (RESPONSE).

(PAUSE THREE TO FIVE SECONDS BETWEEN EACH PAIR.)

Pairings and sequence of stimulus/response pairs:

Stimulus Member:	Response Member:
vom	apple
und	baby
tud	kitten
sul	shoe
roz	duck
poh	leg
omp	bread
mog	table
kiv	rabbit
jus	bird

(USE THE FOLLOWING FOR THE RESPONSE MEASUREMENT TAPE.)

NOW THAT YOU HAVE RECEIVED ALL TEN PAIRS, WE'LL CHECK YOUR RECALL. YOU WILL BE GIVEN A NUMBER AND A NONSENSE WORD. YOU WILL HAVE TEN SECONDS TO WRITE THE APPROPRIATE COMMON WORD BY THE APPROPRIATE NUMBER.

(USE THE FOLLOWING STYLE FOR ALL STIMULUS WORDS.)

NUMBER (ONE, TWO, ETC.) IS (STIMULUS). WHAT DID (STIMULUS) GO WITH?

(PAUSE TEN SECONDS AFTER PRESENTING EACH WORD.)

Sequence for stimulus only presentation:

poh, omp, jus, vom, tud, mog, und, sul, kiv, roz

PROCEDURES FOR MEASURING THE INTERACTIVE LEARNING STYLE

Equipment: This document and response sheets.

1. Seat subject where he or she is at the same level and face to face with the primary evaluator. Secondary evaluator should sit to one side and prepare to score the responses. Scoring must be accomplished without distracting or prompting the subject.

2. Primary evaluator presents stimulus/response pairs using the following script.

    THE NONSENSE WORD IN THIS PAIR IS (STIMULUS), AND THE COMMON WORD IS (RESPONSE). PLEASE REPEAT BOTH WORDS.

    (REPEAT AS NECESSARY UNTIL SUBJECT CAN SAY BOTH WORDS.)

    HOW WILL YOU REMEMBER THIS PAIR OF WORDS?

    (ALLOW TEN SECONDS FOR SUBJECT TO RESPOND TO QUESTION.)

    (DO NOT COMMENT ON SUBJECT'S REPLY.)

    Pairings and sequence of stimulus/response pairs:

Stimulus Member:	Response Member:
zed	wind
fai	tooth
ces	ball
hez	Christmas
sci	fire
pex	floor
chi	egg
jec	dog
toz	milk
zon	toy

3. Primary evaluator presents stimulus words and asks the subject to state the response words. Use the following script.

    THE NONSENSE WORD IS (STIMULUS). WHAT WAS STIMULUS) PAIRED WITH? (ALLOW TEN SECONDS FOR THE RESPONSE.)

    Sequence for stimulus only presentation:

    hez, zed, sci, chi, fai, jec, toz, ces, pex, zon

4. Secondary evaluator completes scoring without reporting results to subject.

5. Subject is instructed to return to the coordinator for next assignment.

PROCEDURES FOR MEASURING THE VISUAL LEARNING STYLE

Equipment: Two 35MM slide projectors, slides, screen, response sheets, and pencils.

1. Place subjects approximately six feet from screen.
2. Distribute response sheets (face down) and pencils.
3. Display each stimulus member and response member pair at seven second intervals.
4. Have subjects pick up pencils and prepare to respond.
5. Announce number of response and display each stimulus member for ten seconds; e.g., "Number one (ten seconds), Number two (ten seconds), etc...."
6. Collect answer sheets.

Pairings and sequence of stimulus/response pairs:

Stimulus Member: (Symbols)	Response Member: (Picture)
Square	Tree
Circle	Hat
Triangle	Chair
Rectangle	Boot
Plus Sign	Window
Star (open)	Boat
Oval	Flower
Asterisk	Umbrella
Diamond	Scissors
Infinity Sign	Eye Glasses

Sequence for stimulus only display:

Asterisk, Circle, Plus Sign, Rectangle, Infinity Sign, Oval, Diamond, Square, Star, Triangle

PROCEDURES FOR MEASURING THE HAPTIC LEARNING STYLE

Equipment: Small desk or table, box of twenty stimulus/response items, blindfold, and response sheets.

1. Seat subject across table from primary evaluator.

2. Have subject put on blindfold.

3. Place stimulus member of each pair in subject's hand, place corresponding response member in subject's hand, and wait seven seconds before taking both items from the subject. Repeat process for all ten pairs.

4. Place each stimulus member in subject's hand, and ask subject to identify the paired response item.

   PLEASE DESCRIBE OR IDENTIFY THE ITEM THAT THIS ITEM WAS PAIRED WITH.

   Allow ten seconds for the subject to reply. Do not comment on the subject's reply. Repeat process for all ten stimulus items.

5. Second evaluator keeps score without reporting results to the subject.

Pairings and sequence of stimulus/response pairs:

Stimulus Member:	Response Member:
Piece of Carpet	Light Bulb
Rock	Pencil
Table Leg	Tennis Ball
Hose Coupeling	Paint Brush
Wooden Rectangle	Table Fork
Bushing	Key Ring
Metal Tube	Scissors
Odd Shaped Piece of Wood	YoYo
Plastic Gold Ball	Padlock
Door Knob	Drinking Glass

Sequence for stimulus only presentation:

Piece of Carpet, Plastic Golf Ball, Odd Shaped Piece of Wood, Bushing, Table Leg, Wooden Rectangle, Rock, Door Knob, Metal Tube, Hose Coupeling

PROCEDURES FOR MEASURING THE KINESTHETIC LEARNING STYLE

Equipment: This document, blindfold, and response sheets

1. As subject arrives, announce:

   THIS EVALUATION INVOLVES BODY MOVEMENT; THERE WILL BE LIMITED SPOKEN DIRECTIONS DURING THIS PROCEDURE. FROM THIS (IDENTIFY) STARTING POINT, I'LL GUIDE AND DIRECT YOU THROUGH TEN PAIRS OF BODY MOVEMENTS. YOU WILL BE BLINDFOLDED; THEREFORE, I'LL STAY CLOSE BY YOU TO KEEP YOU STEADY AND PREVENT ANY ACCIDENTS. AFTER WE HAVE COMPLETED THE TEN PAIRS OF MOVEMENTS, I'LL GUIDE AND DIRECT YOU THROUGH THE FIRST MOVEMENT OF EACH PAIR. YOU ARE TO RESPOND BY PERFORMING OR DESCRIBING THE MOVEMENT THAT THE FIRST MOVEMENT WAS PAIRED WITH. LET'S BEGIN.

2. Have subject put on the blindfold.

3. Move subject through the stimulus/response pairs. As necessary, use the following spoken directions.

   THE FIRST MOVEMENT IS <u>(STIMULUS)</u>. IT IS PAIRED WITH <u>(RESPONSE)</u>.

   The evaluator should start each movement by gently placing his or her hands on the subject's shoulders. The various movements will require gentle movements of the subject's arms and legs. This must be accomplished without alarming the subject in any way. As necessary, additional verbal directions may be used, but those directions must not detract from the actual movements.

4. Move the subject through the various stimulus movements and allow ten seconds for the subject to respond by performing or describing the paired movement. It may be necessary to say: THIS MOVEMENT IS <u>(STIMULUS)</u>. WHAT WAS IT PAIRED WITH?

5. Second evaluator scores the responses without reporting the results to the subject.

Pairings and sequence of stimulus/response pairs:

Stimulus Member:	Response Member:
Move diagonally across the room and return	Stoop
Stand on one leg	Raise both hands into air
Rotate left arm	Bend over forward
Hands on hips	Alternate raising both legs
Left arm over head	Walk in circle
Clasp hands over head, lower to side	Take two steps forward and return
Twist body in circle	Clasp hands in front of body
With right arm, draw an "O" in the air	Stand spread eagle
Cross arms over head	Hands behind head
Get on hands and Knees	Stand at attention

Sequence for stimulus only presentation:

Stand on one leg, Get on hands and knees, With right arm, draw an "O" in the air, Cross arms over head, Hands on hips, Move diagonally across the room and return, Clasp hands over head, lower to side, Left arm over head, Twist body in circle, Rotate left arm

PROCEDURES FOR MEASURING THE OLFACTORY LEARNING STYLE

Equipment: Small desk or table, aroma vials, blindfold, and response sheets.

1. Seat subject across table from primary evaluator.

2. Make the following statement:

> FOR THIS EVALUATION, YOU WILL BE BLINDFOLDED AND GIVEN VIALS CONTAINING DIFFERENT AROMAS. FIRST, YOU WILL BE PRESENTED WITH PAIRS OF AROMAS. THE FIRST VIAL OF EACH PAIR CONTAINS AN ABSTRACT AROMA AND IT WILL NOT BE IDENTIFIED. THE SECOND VIAL OF EACH PAIR CONTAINS A COMMON AROMA, AND I WILL IDENTIFY IT FOR YOU. YOUR JOB IS TO REMEMBER WHICH PAIR OF AROMAS GO TOGETHER. AFTER EXAMINING ALL TEN PAIRS, YOU WILL BE GIVEN THE VIAL CONTAINING THE FIRST AROMA IN EACH PAIR. YOU ARE TO IDENTIFY THE NAME OF THE AROMA IT WAS PAIRED WITH.

3. Have subject put on blindfold.

4. Present the stimulus/response pairs as follows.

> THIS IS THE FIRST AROMA OF THIS PAIR. (GIVE VIAL TO SUBJECT, AND HELP HIM OR HER LIFT IT TO HIS OR HER NOSE.) THIS IS THE SECOND AROMA OF THIS PAIR. (SAME PROCEDURE) THIS SECOND AROMA IS THE SMELL OF <u>(RESPONSE AROMA)</u>. (ALLOW THE SUBJECT TO EXAMINE EACH PAIR FOR <u>SEVEN</u> SECONDS.)

5. Present subject with stimulus member vial of each pair and allow him or her ten seconds to identify the appropriate response aroma. It may be necessary to say: THIS IS ONE OF THE ABSTRACT AROMAS; WHAT WAS IT PAIRED WITH? Present all ten stimulus vials in the same manner while second evaluator records results.

Pairings and sequence of stimulus/response pairs:

Stimulus Member: (Vial number and aroma)	Response Member: (Vial number and aroma)
#1, Cherry	#11, Peppermint
#2, Vanilla	#12, Strawberry ✓
#3, Almond	#13, Orange (oil)
#4, Raspberry	#14, Butter
#5, Pineapple	#15, Chocolate ✓
#6, Brandy	#16, Coconut
#7, Pine Needles	#17, Licorice
#8, Banana	#18, Oil of Cloves
#9, Maple ✓	#19, Lemon
#10, Wintergreen	#20, Cinnamon

Sequence for stimulus only presentation:

#2, Vanilla; #4, Raspberry; #9; Maple; #1, Cherry; #3, Almond; #5, Pineapple; #7, Pine Needles; #6, Brandy; #10, Wintergreen

Notation on sources and safety of chemicals used in olfactory measurement:

Vial Number and Aroma:	Source of Chemical:
#1, Cherry	Wagner's Natural Cherry Flavor Extract
#2, Vanilla	Ann Page Pure Vanilla Extract
#3, Almond	Ann Page Pure Almond Extract
#4, Raspberry	Wagner's Natural Raspberry Flavored Extract
#5, Pineapple	McCormick Imitation Pineapple Extract
#6, Brandy	McCormick Imitation Brandy Extract
#7, Pine Needles	Magnus, Mabee, and Reynard Pine Needle Oil Siberian Candle Scent
#8, Banana	McCormick Imitation Banana Extract
#9,Maple	Lorann Articial Maple Flavor Candle Scent
#10,Wintergreen	Lorann Natural Wintergreen Candle Scent
#11, Peppermint	Carroll Chemical Co. Peppermint Spirit N. F.
#12, Strawberry	McCormick Imitation Strawberry Extract
#13, Orange (oil)	Magnus, Mabee, and Reynard Orange
#14, Butter	McCormick Imitation Butter Flavor
#15, Chocolate	McCormick Chocolate Extract

Vial Number and Aroma:	Source of Chemical:
#16, Coconut	McCormick Imitation Coconut Extract
#17, Licorice	Lorann Artificial Licorice Flavor Candle Scent
#18, Oil of Cloves	DeWitt's Oil of Cloes U.S.P.
#19, Lemon	Ann Page Pure Lemon Extract
#20, Cinnamon	Compton and Knowles Oil of Cinnamon

Notes: All elements and procedures have been certified as safe by an organic chemist.

RESPONSE AND CHECK SHEETS
PACKET

RESPONSE SHEET
PRINT
LEARNING STYLE
SUBJECT NUMBER:_____

NONSENSE WORD NUMBER:	COMMON WORD:
1.	_____
2.	_____
3.	_____
4.	_____
5.	_____
6.	_____
7.	_____
8.	_____
9.	_____
10.	_____

CHECK SHEET
HAPTIC
LEARNING STYLE
SUBJECT NUMBER:_____

STIMULUS MEMBER:	RESPONSE MEMBER:	SUBJECT CORRECT	RESPONSES INCORRECT
PIECE OF CARPET	LIGHT BULB		
PLASTIC GOLF BALL	PADLOCK		
ODD SHAPED PIECE OF WOOD	YO YO		
BUSHING	KEY RING		
TABLE LEG	TENNIS BALL		
WOODEN RECTANGLE	TABLE FORK		
ROCK	PENCIL		
DOOR KNOB	DRINKING GLASS		
METAL TUBE	SCISSORS		
HOSE COUPLING	PAINT BRUSH		

TOTAL CORRECT: _____

RESPONSE SHEET
VISUAL
LEARNING STYLE
SUBJECT NUMBER: _____

SYMBOL NUMBER:	PICTURE:
1.	_____
2.	_____
3.	_____
4.	_____
5.	_____
6.	_____
7.	_____
8.	_____
9.	_____
10.	_____

RESPONSE SHEET
AURAL
LEARNING STYLE
SUBJECT NUMBER: _____

NONSENSE WORD NUMBER:	COMMON WORD:
1.	_____
2.	_____
3.	_____
4.	_____
5.	_____
6.	_____
7.	_____
8.	_____
9.	_____
10.	_____

CHECK SHEET
OLFACTORY
LEARNING STYLE
SUBJECT NUMBER:_____

STIMULUS NUMBER:	RESPONSE AROMA:	SUBJECT CORRECT	RESPONSES INCORRECT
2	STRAWBERRY		
4	BUTTER		
9	LEMON		
8	OIL OF CLOVES		
1	PEPPERMINT		
3	ORANGE (OIL)		
5	CHOCOLATE		
7	LICORICE		
6	COCONUT		
10	CINNAMON		

TOTAL CORRECT: _____

PARTICIPANT'S INITIAL REPORT
SUBJECT NUMBER:_____

The written survey will be machine scored, and you will receive a final report in the mail. Today's results on the MMPALT are as follows.

LEARNING STYLE	SCORE	RANK ORDER
PRINT	_____	_____
AURAL	_____	_____
INTERACTIVE	_____	_____
VISUAL	_____	_____
HAPTIC	_____	_____
KINESTHETIC	_____	_____
OLFACTORY	_____	_____

If these results are a true reflection of your strengths as a learner, the style ranked #1 is your best method for studying and learning. Therefore, you might consider using that style as much as possible, and, at the same time, improve your skills in the the other styles. Example: If aural is #1, you can learn best by listening If print is #7, try to improve your reading skills.

Comments:

CHECK SHEET
INTERACTIVE
LEARNING STYLE
SUBJECT NUMBER: _____

NONSENSE WORD:	COMMON WORD:	SUBJECT CORRECT	RESPONSES INCORRECT
hez	CHRISTMAS		
zed	WIND		
sci	FIRE		
chi	EGG		
fai	TOOTH		
jec	DOG		
toz	MILK		
ces	BALL		
pex	FLOOR		
zon	TOY		

TOTAL CORRECT: _____

CHECK SHEET
KINESTHETIC
LEARNING STYLE
SUBJECT NUMBER: _____

STIMULUS MEMBER:	RESPONSE MEMBER:	SUBJECT CORRECT	RESPONSES INCORRECT
STAND ON ONE	HANDS IN AIR		
GET ON HANDS AND KNEES	STAND AT ATTENTION		
WITH RIGHT ARM, DRAW AN "O" IN THE AIR	STAND SPREAD EAGLE		
CROSS ARMS OVER HEAD	HANDS BEHIND HEAD		
HANDS ON HIPS	RAISE BOTH LEGS (ALT.)		
MOVE DIAGONALLY ACROSS ROOM AND RETURN	STOOP		
CLASP HANDS OVER HEAD, LOWER TO SIDE	TAKE TWO STEPS FWD AND RETURN		
LEFT ARM OVER HEAD	WALK IN A CIRCLE		
TWIST BODY IN CIRCLE	CLASP HANDS IN FRONT		
ROTATE LEFT ARM	BEND OVER FORWARD		

TOTAL CORRECT: _____

APPENDIX D

THE PERCEPTUAL MODALITY PREFERENCE SURVEY

PERCEPTUAL MODALITY PREFERENCE SURVEY

This survey is designed to help you identify your style of learning. It specifically deals with how you best receive new information or knowledge. The results of this survey will help you plan your future learning experiences.

You will be responding to forty-two statements concerning how you learn best. This is not a test; there are no right or wrong answers. When making your responses, you should consider your past learning experiences and your own intuitions about your learning style.

The response choices are: ALWAYS, USUALLY, SELDOM, and NEVER. The always response indicates that the statement is a strong representation of your learning style preference. If the statement is a good way for you to learn, but not your most preferred, you should mark "usually." If the statement indicates a way you can learn, but you would prefer other methods, mark your response as "seldom." The never response indicates that you reject that statement as a way for you to learn.

The construction of the survey requires that you respond to all statements in the order presented. Therefore, do not omit responses or skip statements.

If you are using the machine scored response sheet mark column 1 for always, column 2 for usually, column 3 for seldom, and column 4 for never.

1. I can learn better by reading than by listening.
2. I can learn better by listening than by talking with others.
3. I can learn better by talking with others than by looking at things like movies and slides.
4. I can learn better by looking at things like movies and slides than by touching or holding objects.
5. I can learn better by touching or holding objects than by physically participating in activities such as sports or games.
6. I can learn better by physically participating in activities such as sports and games than by smelling things.
7. I can learn better by smelling things than by reading.
8. I can learn better by reading than by talking with others.
9. I can learn better by talking with others than by touching of holding objects.
10. I can learn better by touching or holding objects than by smelling things.
11. I can learn better by smelling things than by listening.
12. I can learn better by listening than by looking at things like movies and slides.
13. I can learn better by looking at things like movies and slides than by physically participating in activities such as sports and games.
14. I can learn better by physically participating in activities such as sports and games than by reading.
15. I can learn better by reading than by looking at things like movies and slides.
16. I can learn better by looking at things like movies and slides than by smelling things.
17. I can learn better by smelling things than by talking with others.
18. I can learn better by talking with others than by physically participating in activities such as sports and games.

19. I can learn better by physically participating in activities such as sports and games than by listening.

20. I can learn better by listening than by touching or holding objects.

21. I can learn better by touching or holding objects than by reading.

22. I can learn better by reading than by smelling things.

23. I can learn better by smelling things than by physically participating in activities such as sports and games.

24. I can learn better by physically participating in activities such as sports and games than by touching or holding objects.

25. I can learn better by touching or holding objects than by looking at things like movies and slides.

26. I can learn better by looking at things like movies and slides than by talking with others.

27. I can learn better by talking with others than by listening.

28. I can learn better by listening than by reading.

29. I can learn better by reading than by physically participating in activities such as sports and games.

30. I can learn better by physically participating in activities such as sports and games than by looking at things like movies and slides.

31. I can learn better by looking at things like movies and slides than by listening.

32. I can learn better by listening than by smelling things.

33. I can learn better by smelling things than by touching or holding objects.

34. I can learn better by touching or holding objects than by talking with others.

35. I can learn better by talking with others than by reading.

36. I can learn better by reading than by touching or holding objects.

37. I can learn better by touching or holding objects than by listening.

38. I can learn better by listening than by physically participating in activities such as sports and games.

39. I can learn better by physically participating in activities such as sports and games than by taking with others.

40. I can learn better by talking with others than by smelling things.

41. I can learn better by smelling things than by looking at things like movies and slides.

42. I can learn better by looking at things like movies and slides than by reading.

PERCEPTUAL MODALITY PREFERENCE SURVEY
SCORING SYSTEM

Each survey statement contains two contrasting perceptual modality elements. Each element is included in 12 different statements; 6 times in the primary or first position and 6 times in the secondary or last position. Each element can therefore, be scored 12 times. When listed in the primary position, the element will be scored: Always = +4, Usually = +2, Seldom = -2, and Never = -4. When listed in the secondary position, the element will be scored: Always = -2, Usually = -1, Seldom = +1, and Never = +2. The maximum possible score range for any element is +36 to -36.

Print Element Statements:

Primary Position: 1, 8, 15, 22, 29, and 36.
Secondary Position: 7, 14, 21, 28, 35, and 42.

Aural Element Statements:

Primary Position: 2, 12, 20, 28, 32, and 38.
Secondary Position: 1, 11, 19, 27, 31, and 37.

Interactive Element Statements:

Primary Position: 3, 9, 18, 27, 35, and 40.
Secondary Position: 2, 8, 17, 26, 34, and 39.

Visual Element Statements:

Primary Position: 4, 13, 16, 26, 31, and 42.
Secondary Position: 3, 12, 15, 25, 30, and 41.

Haptic Element Statements:

Primary Position: 5, 10, 21, 25, 34, and 37.
Secondary Position: 4, 9, 20, 24, 33, and 36.

Kinesthetic Element Statements:

Primary Position: 6, 14, 19, 24, 30, and 39.
Secondary Position: 5, 13, 18, 23, 29, and 38.

Olfactory Element Statements:

Primary Position: 7, 11, 17, 23, 33, and 41.
Secondary Position: 6, 10, 16, 22, 32, and 40.

APPENDIX E

DEMOGRAPHIC DATA BY SUBJECT NUMBER

Subject Number	Sex	Age	Years of Education	State of Residence
1	F	68	16	Tennessee
2	F	52	16	Tennessee
3	F	42	12	Tennessee
4	M	44	16	Tennessee
5	M	60	14	Tennessee
6	F	43	14	Tennessee
7	M	51	16	Tennessee
8	F	35	16	Tennessee
9	M	21	14	Tennessee
10	M	40	14	Tennessee
11	M	36	12	Tennessee
12	M	34	12	North Carolina
13	M	27	14	South Carolina
14	M	38	12	Wisconsin
15	M	26	13	California
16	M	48	13	Tennessee
17	M	44	16	Tennessee
18	F	39	14	Tennessee
19	M	38	13	South Carolina
20	M	23	15	Tennessee
21	M	22	12	Tennessee
22	F	21	13	Tennessee
23	F	35	11	Tennessee
24	M	40	12	Idaho
25	M	27	16	Hawaii
26	F	23	16	Ohio
27	F	32	16	Texas
28	M	29	16	New Jersey
29	M	26	15	Utah
30	M	24	16	Tennessee
31	M	25	16	Missouri
32	M	22	14	South Dakota
33	M	40	16	Ohio
34	M	35	16	Mississippi
35	M	31	16	North Carolina
36	M	35	16	Tennessee
37	M	26	16	Massachusetts
38	M	26	15	Idaho
39	F	31	13	California
40	M	27	14	Maine
41	M	24	15	South Carolina
42	M	28	16	New Jersey
43	M	29	15	Pennsylvania
44	M	28	16	Virginia
45	M	25	8	Tennessee
46	M	27	12	Tennessee
47	M	24	12	Tennessee
48	M	39	12	Tennessee

Subject Number	Sex	Age	Years of Education	State of Residence
49	M	40	16	Tennessee
50	M	26	10	Tennessee
51	F	21	10	Tennessee
52	F	21	11	Tennessee
53	F	29	11	Tennessee
54	F	29	15	Connecticut
55	F	37	8	Tennessee
56	M	37	16	Wisconsin
57	M	24	14	Illinois
58	M	24	9	Tennessee
59	M	35	10	Tennessee
60	M	24	14	Kentucky
61	F	32	12	Rhode Island
62	M	31	15	North Carolina
63	M	34	16	Tennessee
64	M	44	16	Mississippi
65	M	31	12	West Virginia
66	M	50	12	Montana
67	M	41	12	Oregon
68	M	49	13	Ohio
69	M	41	13	Indiana
70	M	38	13	Arkansas
71	M	39	15	Utah
72	M	33	12	New York
73	M	48	12	Tennessee
74	M	50	12	Connecticut
75	M	35	14	Kentucky
76	M	28	15	Montana
77	M	28	12	California
78	F	29	14	Illinois
79	M	28	12	New Jersey
80	M	40	14	Arkansas
81	M	36	12	Vermont
82	M	49	12	Connecticut
83	M	43	14	Mississippi
84	F	38	16	Tennessee
85	M	36	14	California
86	M	35	14	Washington
87	M	39	14	Missouri
88	M	32	15	California
89	M	24	10	Tennessee
90	F	28	15	Tennessee
91	M	52	16	Georgia
92	M	35	14	Texas
93	M	44	12	New Jersey
94	M	41	14	Kentucky
95	M	30	12	Tennessee
96	M	19	10	Tennessee

APPENDIX F

TABLE IX

SUMMARY OF SUBJECT GROUP RANKS, SCORES, AND CORRELATIONS

Subject Group	Measurement	Ranks (Scores) by Element: Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	Olfac-tory	Total Score	Correl-lation
ALL	PMPS	4 (243)	5 (146)	3 (790)	2 (799)	6 (-251)	1 (896)	7 (-2427)	196	
(96)	*(r)MMPALT	5 (453)	3 (477)	4 (466)	1 (726)	2 (530)	6 (277)	7 (104)	3033	.14
PMPS	PMPS	4 (156)	5 (43)	3 (328)	2 (329)	6 (-214)	1 (496)	7 (-1057)	81	
First	(r)MMPALT	5 (187)	3 (224)	4 (207)	1 (333)	2 (260)	6 (137)	7 (36)	1384	.14
(43)										
PMPS	PMPS	5 (87)	4 (103)	2 (462)	1 (470)	6 (- 37)	3 (400)	7 (-1370)	115	
Last	(r)MMPALT	3 (266)	5 (253)	4 (259)	1 (393)	2 (270)	6 (140)	7 (68)	1649	.39
(43)										
Males	PMPS	4 (134)	5 (97)	2 (599)	3 (547)	6 (-169)	1 (801)	7 (-1924)	85	
(76)	(r)MMPALT	5 (349)	4 (369)	3 (373)	1 (590)	2 (418)	6 (231)	7 (83)	2413	.14
Females	PMPS	3 (109)	5 (49)	2 (191)	1 (252)	6 (- 82)	4 (95)	7 (- 503)	111	
(20)	(r)MMPALT	4 (104)	3 (108)	5 (93)	1 (136)	2 (112)	6 (46)	7 (21)	620	.39
ABE	PMPS	5 (-13)	4 (38)	2 (71)	3 (47)	6 (- 85)	1 (123)	7 (- 208)	- 27	
(9)	(r)MMPALT	3.5 (26)	3.5 (26)	5 (18)	1 (43)	2 (31)	6 (11)	7 (6)	161	-.02
Jail	PMPS	6 (-15)	3 (35)	2 (65)	4 (3)	5 (- 13)	1 (90)	7 (- 138)	27	
(7)	(r)MMPALT	4 (18)	2 (21)	5 (17)	1 (32)	3 (19)	6 (8)	7 (4)	119	.07
PMEC	PMPS	4 (208)	5 (47)	3 (373)	2 (536)	6 (- 78)	1 (647)	7 (-1539)	194	
(60)	(r)MMPALT	5 (292)	4 (321)	3 (327)	1 (496)	2 (350)	6 (195)	7 (70)	2051	.21

*revised

TABLE IX (CONTINUED)

Subject Group	Measurement	Ranks (Scores) by Element: Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	Olfac-tory	Total Score	Correl-lation
NCOA	PMPS	4 (105)	6 (3)	3 (258)	2 (261)	5 (10)	1 (339)	7 (- 860)	116	
(34)	*(r)MMPALT	5 (141)	4 (161)	3 (172)	1 (274)	2 (173)	6 (103)	7 (41)	1065	.29
AMS	PMPS	4 (66)	5 (26)	3 (119)	2 (213)	6 (- 62)	1 (218)	7 (- 525)	55	
(20)	(r)MMPALT	5 (118)	3 (125)	4 (119)	1 (173)	2 (142)	6 (68)	7 (22)	767	.14
LS	PMPS	3 (37)	4 (18)	5 (- 4)	2 (62)	6 (- 26)	1 (90)	7 (- 154)	23	
(6)	(r)MMPALT	5 (33)	3.5 (35)	2 (36)	1 (49)	3.5 (35)	6 (24)	7 (7)	219	.18
Test	PMPS	3 (98)	4 (26)	1 (134)	2 (115)	6 (- 72)	5 (8)	7 (- 299)	10	
(10)	(r)MMPALT	3.5 (54)	3.5 (54)	5 (47)	1 (67)	2 (60)	6 (30)	7 (11)	323	.38
Col-leagues	PMPS	3 (65)	4 (42)	1 (260)	2 (211)	6 (- 73)	6 (15)	7 (- 519)	1	
(19)	(r)MMPALT	3 (109)	4 (100)	5 (98)	1 (145)	2 (122)	6 (60)	7 (22)	656	.39
Education:										
Under 12 years	PMPS	5 (-49)	3 (64)	2 (112)	4 (34)	6 (- 70)	1 (117)	7 (- 237)	- 29	
(11)	(r)MMPALT	4 (27)	3 (30)	5 (21)	1 (49)	2 (35)	6 (12)	7 (7)	181	-.07
12 years	PMPS	5 (- 2)	6 (-70)	2 (195)	3 (96)	4 (14)	1 (391)	7 (- 527)	97	
(22)	(r)MMPALT	5 (82)	4 (87)	3 (96)	1 (162)	2 (97)	6 (68)	7 (18)	610	.32
Some College	PMPS	4 (190)	5 (87)	3 (206)	1 (391)	6 (- 64)	2 (309)	7 (-1006)	113	
(38)	(r)MMPALT	5 (195)	3 (223)	4 (210)	1 (308)	2 (234)	6 (113)	7 (47)	1330	.32

*revised

TABLE IX (CONTINUED)

Subject Group	Measurement	Ranks (Scores) by Element: Print	Aural	Inter-Active	Visual	Haptic	Kines-thetic	Olfac-tory	Total Score	Correl-lation
16 years or more (25)	PMPS	3 (104)	5 (65)	2 (277)	1 (278)	6 (-131)	4 (79)	7 (- 657)	15	
	*(r)MMPALT	3 (149)	5 (137)	4 (139)	1 (207)	2 (164)	6 (84)	7 (32)	912	.57
Age:										
19-24 (16)	PMPS	6 (-113)	4 (28)	2 (175)	3 (78)	5 (- 15)	1 (288)	7 (- 433)	8	
	(r)MMPALT	3 (86)	5 (72)	4 (73)	1 (118)	2 (87)	6 (44)	7 (16)	496	.07
25-29 (22)	PMPS	2 (169)	4 (85)	5 (82)	1 (238)	6 (-165)	3 (149)	7 (- 526)	33	
	(r)MMPALT	5 (94)	4 (107)	3 (114)	1 (163)	2 (119)	6 (65)	7 (22)	684	.32
30-34 (11)	PMPS	4 (4)	5 (3)	3 (74)	2 (89)	6 (- 76)	1 (170)	7 (- 244)	20	
	(r)MMPALT	5 (56)	2 (67)	4 (58)	1 (85)	3 (62)	6 (34)	7 (18)	380	.18
35-39 (21)	PMPS	4 (132)	6 (-12)	3 (144)	1 (174)	5 (12)	2 (159)	7 (- 537)	72	
	(r)MMPALT	5 (105)	3 (116)	4 (107)	1 (164)	2 (123)	6 (57)	7 (21)	693	.36
40-44 (15)	PMPS	5 (16)	6 (- 4)	1 (195)	2 (156)	3 (34)	4 (31)	7 (- 389)	39	
	(r)MMPALT	3 (78)	4 (77)	5 (75)	1 (113)	2 (84)	6 (43)	7 (20)	490	.46
45-68 (11)	PMPS	5 (35)	4 (46)	1 (120)	3 (64)	6 (- 42)	2 (99)	7 (- 298)	24	
	(r)MMPALT	5.5 (34)	4 (38)	3 (39)	1 (83)	2 (55)	5.5 (34)	7 (7)	290	.35

*revised

APPENDIX G

TABLE X

SUMMARY OF INDIVIDUAL SUBJECT RANKS, SCORES, AND CORRELATIONS
(Subjects 1 - 96)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	Olfac-tory	Total Score	Correl-ation
1	PMPS	1 (24)	4 (7)	5 (6)	2 (9)	6 (-21)	3 (8)	7 (-33)	0	
	*(r)MMPALT	6 (0)	6 (0)	3.5 (1)	3.5 (0)	2 (2)	1 (4)	6 (0)	8	-.02
2	PMPS	2 (29)	4 (1)	3 (10)	1 (31)	5 (- 8)	6 (-22)	7 (-33)	8	
	(r)MMPALT	1 (10)	3 (8)	4 (7)	2 (9)	5 (6)	6.5 (4)	6.5 (4)	48	.92
3	PMPS	3 (3)	6 (- 8)	2 (16)	4 (2)	5 (- 6)	1 (21)	7 (-24)	4	
	(r)MMPALT	7 (0)	1 (6)	4.5 (2)	2.5 (3)	2.5 (3)	4.5 (2)	6 (1)	17	-.25
4	PMPS	4 (- 1)	5 (-13)	1 (26)	2 (16)	6 (-18)	3 (8)	7 (-27)	-9	
	(r)MMPALT	1 (6)	7 (0)	3.5 (3)	3.5 (3)	2 (4)	5 (2)	6 (1)	19	.23
5	PMPS	1 (21)	3 (7)	5 (-3)	3 (7)	6 (- 7)	3 (7)	7 (-35)	-3	
	(r)MMPALT	4.5 (3)	3 (6)	4.5 (3)	2 (8)	1 (10)	6 (1)	7 (0)	31	.11
6	PMPS	3 (17)	5 (2)	4 (4)	1 (28)	2 (21)	6.5 (-31)	6.5 (-31)	10	
	(r)MMPALT	2.5 (10)	2.5 (10)	5 (9)	2.5 (10)	2.5 (10)	6.5 (3)	6.5 (3)	55	.80
7	PMPS	6 (-19)	3 (6)	1 (22)	4 (3)	5 (- 5)	2 (11)	7 (-33)	-15	
	(r)MMPALT	4 (5)	4 (5)	4 (5)	2 (8)	1 (9)	6 (3)	7 (0)	35	.07
8	PMPS	4 (8)	2 (13)	1 (26)	3 (11)	4 (1)	6 (-19)	7 (-36)	4	
	(r)MMPALT	4 (6)	5 (5)	2 (8)	2 (8)	2 (8)	6 (2)	7 (0)	37	.63
9	PMPS	2 (8)	3 (2)	4.5 (-2)	6 (-4)	4.5 (- 2)	1 (18)	7 (-18)	2	
	(r)MMPALT	2.5 (8)	4 (7)	6 (5)	1 (10)	5 (6)	2.5 (8)	7 (0)	44	.44

*revised MMPALT

TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	Olfac-tory	Total Score	Correl-ation
10	PMPS	4 (8)	3 (9)	1 (29)	2 (12)	6 (-27)	5 (7)	7 (-29)	9	
	*(r)MMPALT	3 (6)	1.5 (7)	4 (4)	1.5 (7)	5.5 (2)	7 (1)	5.5 (2)	29	.65
11	PMPS	4.5 (- 2)	6 (-16)	1.5 (21)	3 (2)	4.5 (- 2)	1.5 (21)	7 (-23)	1	
	(r)MMPALT	3.5 (8)	2 (9)	5 (6)	1 (10)	3.5 (8)	6 (3)	7 (2)	46	.00
12	PMPS	4.5 (- 3)	6 (- 4)	1 (19)	3 (15)	4.5 (- 3)	2 (17)	7 (-36)	5	
	(r)MMPALT	2 (9)	3.5 (7)	3.5 (7)	1 (10)	6 (5)	5 (6)	7 (2)	46	.38
13	PMPS	6 (-24)	4 (- 2)	3 (11)	2 (20)	5 (-13)	1 (36)	7 (-30)	-2	
	(r)MMPALT	7 (0)	5 (1)	1 (3)	2.5 (2)	2.5 (2)	5 (1)	5 (1)	10	.39
14	PMPS	3 (7)	6 (- 9)	4 (2)	2 (8)	5 (- 3)	1 (21)	7 (-33)	-7	
	(r)MMPALT	5 (3)	5 (3)	1 (6)	2 (5)	3 (4)	5 (3)	7 (0)	24	.37
15	PMPS	1 (31)	4 (1)	3 (10)	2 (20)	5.5 (-23)	5.5 (-23)	7 (-24)	-8	
	(r)MMPALT	6 (2)	4 (3)	4 (3)	1.5 (5)	1.5 (5)	4 (3)	7 (1)	22	.16
16	PMPS	4 (- 2)	1 (22)	2 (18	5 (-10)	7 (-18)	3 (10)	6 (-16)	4	
	(r)MMPALT	5.5 (2)	3.5 (3)	3.5 (3)	1 (7)	2 (5)	5.5 (2)	7 (1)	23	.07
17	PMPS	4 (2)	3 (8)	1 (31)	2 (11)	6 (-15)	5 (- 6)	7 (-32)	-1	
	(r)MMPALT	3.5 (7)	5.5 (6)	5.5 (6)	1 (10)	2 (8)	3.5 (7)	7 (0)	44	.16
18	PMPS	6 (- 9)	4 (0)	2 (23)	3 (20)	1 (24)	5 (- 7)	7 (-33)	18	
	(r)MMPALT	2.5 (9)	5 (7)	4 (8)	2.5 (9)	1 (10)	6 (3)	7 (1)	47	.66

*revised

TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Total Score	Correlation
19	PMPS	1.5 (12)	4 (6)	3 (8)	1.5 (12)	6 (-12)	5 (-6)	7 (-18)	2	
	*(r)MMPALT	5.5 (2)	4 (3)	2.5 (4)	1 (6)	2.5 (4)	5.5 (2)	7 (1)	22	.47
20	PMPS	6 (- 9)	5 (1)	3 (9)	2 (17)	1 (19)	4 (2)	7 (-32)	7	
	(r)MMPALT	5 (5)	4 (6)	3 (7)	1.5 (10)	1.5 (10)	6 (4)	7 (2)	44	.88
21	PMPS	6 (-12)	3 (11)	4 (- 1)	5 (-3)	2 (17)	1 (21)	7 (-32)	1	
	(r)MMPALT	2 (8)	3 (6)	6 (2)	1 (9)	4.5 (6)	4.5 (5)	7 (1)	36	.02
22	PMPS	6 (-19)	3 (9)	2 (24)	y1 (27)	5 (- 9)	4 (4)	7 (-29)	7	
	(r)MMPALT	1.5 (9)	4.5 (4)	3 (6)	1.5 (9)	4.5 (4)	6.5 (1)	6.5 (1)	34	.44
23	PMPS	5 (0)	4 (2)	3 (3)	2 (14)	6 (-17)	1 (16)	7 (-27)	-9	
	(r)MMPALT	4.5 (3)	3 (4)	6 (1)	1 (7)	2 (5)	4.5 (3)	7 (0)	23	.29
24	PMPS	4 (3)	3 (9)	1 (22)	2 (11)	6 (-11)	5 (-2)	7 (-36)	-4	
	(r)MMPALT	2 (8)	2 (8)	2 (8)	4 (7)	5 (6)	6 (4)	7 (1)	42	.78
25	PMPS	4 (4)	6 (-8)	2 (8)	3 (6)	5 (- 6)	1 (18)	7 (-18)	4	
	(r)MMPALT	3 (7)	6 (3)	3 (7)	1 (10)	3 (7)	5 (5)	7 (1)	40	.52
26	PMPS	6 (-15)	5 (-4)	2 (11)	4 (1)	3 (6)	1 (19)	7 (-22)	-4	
	(r)MMPALT	1.5 (10)	3 (9)	5 (4)	1.5 (10)	4 (8)	6 (3)	7 (1)	45	-.18
27	PMPS	2 (28)	5 (-7)	4 (4)	1 (30)	7 (-26)	3 (12)	6 (-24)	17	
	(r)MMPALT	3.5 (5)	3.5 (5)	5.5 (1)	2 (6)	1 (7)	5.5 (1)	7 (0)	25	.07

*revised

TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	Olfac-tory	Total Score	Correl-ation
28	PMPS	1 (19)	4 (4)	3 (5)	5 (2)	6 (- 6)	2 (9)	7 (-28)	5	
	*(r)MMPALT	3 (5)	3 (5)	6 (2)	1 (10)	5 (4)	3 (5)	7 (1)	32	.41
29	PMPS	4 (5)	3 (7)	5 (-10)	1 (30)	6 (-17)	2 (10)	7 (-20)	5	
	(r)MMPALT	4 (4)	4 (4)	4 (4)	1.5 (9)	1.5 (9)	6 (3)	7 (1)	34	.28
30	PMPS	6 (- 8)	4 (3)	2 (16)	3 (7)	5 (- 6)	1 (21)	7 (-36)	-3	
	(r)MMPALT	3 (8)	5 (6)	2 (9)	1 (10)	4 (7)	6 (3)	7 (2)	45	.29
31	PMPS	1 (23)	3 (7)	4 (0)	6 (-14)	5 (- 7)	2 (17)	7 (-22)	4	
	(r)MMPALT	6 (1)	4.5 (2)	2 (8)	3 (5)	1 (9)	4.5 (2)	7 (0)	27	-.13
32	PMPS	5 (-10)	6 (-19)	4 (9)	3 (10)	2 (16)	1 (31)	7 (-32)	5	
	(r)MMPALT	2.5 (9)	2.5 (9)	5 (5)	2.5 (9)	2.5 (9)	6 (3)	7 (1)	45	.12
33	PMPS	4 (4)	3 (8)	2 (19)	1 (26)	5 (- 7)	6 (-13)	7 (-33)	4	
	(r)MMPALT	5.5 (7)	4 (9)	2 (10)	2 (10)	2 (10)	5.5 (7)	7 (0)	53	.75
34	PMPS	1 (21)	6 (-12)	3 (10)	4 (1)	5 (0)	2 (13)	7 (-34)	-1	
	(r)MMPALT	4.5 (4)	2 (7)	4.5 (4)	1 (10)	3 (5)	7 (1)	6 (2)	33	-.25
35	PMPS	7 (-29)	5 (- 4)	3 (9)	2 (11)	4 (5)	1 (24)	6 (-17)	-1	
	(r)MMPALT	3.5 (5)	3.5 (5)	1 (7)	5 (4)	2 (6)	7 (2)	6 (3)	32	-.22
36	PMPS	2 (17)	3 (12)	5 (-5)	1 (29)	4 (0)	6 (-15)	7 (-29)	9	
	(r)MMPALT	2 (9)	3 (8)	5.5 (4)	1 (10)	4 (6)	5.5 (4)	7 (0)	41	.99

*revised

TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Total Score	Correlation
37	PMPS	5 (5)	1 (22)	3 (8)	2 (11)	6 (-11)	4 (7)	7 (-31)	11	
	*(r)MMPALT	4.5 (4)	4.5 (4)	2 (6)	1 (9)	3 (5)	6 (2)	7 (0)	30	.50
38	PMPS	3 (7)	2 (15)	5 (3)	6 (-10)	1 (17)	4 (5)	7 (-36)	1	
	(r)MMPALT	4 (9)	4 (9)	1.5 (10)	1.5 (10)	4 (9)	6 (4)	7 (2)	53	.06
39	PMPS	2 (22)	3.5 (7)	3.5 (7)	5 (3)	7 (-25)	1 (24)	6 (-22)	16	
	(r)MMPALT	3.5 (7)	1.5 (10)	3.5 (7)	1.5 (10)	5 (6)	6 (4)	7 (1)	45	.11
40	PMPS	3 (5)	6 (- 8)	5 (0)	1 (12)	2 (10)	4 (2)	7 (-19)	2	
	(r)MMPALT	6 (1)	4.5 (3)	4.5 (3)	1 (6)	2.5 (4)	2.5 (4)	7 (0)	21	.75
41	PMPS	6 (-19)	5 (-14)	3 (3)	2 (16)	4 (0)	1 (30)	7 (-23)	-7	
	(r)MMPALT	5 (4)	3 (8)	4 (7)	1 (10)	2 (9)	6 (3)	7 (0)	41	.36
42	PMPS	6 (-13)	2 (11)	3 (8)	1 (29)	5 (-10)	4 (7)	7 (-30)	2	
	(r)MMPALT	3 (5)	5.5 (4)	5.5 (4)	1 (9)	3 (5)	3 (5)	7 (3)	35	.39
43	PMPS	1 (21)	6 (- 6)	5 (-1)	3 (7)	4 (1)	2 (11)	7 (-18)	15	
	(r)MMPALT	4.5 (6)	2.5 (8)	4.5 (6)	1 (9)	2.5 (8)	6 (5)	7 (2)	44	.15
44	PMPS	4.5 (- 2)	2 (10)	3 (0)	4.5 (-2)	6 (-10)	1 (12)	7 (-17)	-9	
	(r)MMPALT	5 (7)	3.5 (9)	1.5 (10)	1.5 (10)	3.5 (9)	6.5 (2)	6.5 (2)	49	.06
45	PMPS	4 (1)	2 (10)	1 (12)	3 (4)	5 (-11)	6 (-16)	7 (-19)	-18	
	(r)MMPALT	6.5 (0)	1 (5)	4.5 (1)	2.5 (2)	2.5 (2)	4.5 (1)	6.5 (0)	11	.48

*revised

TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	Olfac-tory	Total Score	Correl-ation
46	PMPS	1 (26)	6 (- 9)	4 (1)	2 (9)	5 (- 7)	3 (6)	7 (-19)	7	
	*(r)MMPALT	1 (8)	5 (4)	2 (7)	3 (6)	4 (5)	5 (1)	7 (0)	31	.71
47	PMPS	4 (0)	3 (2)	2 (17)	6 (-12)	5 (- 8)	1 (34)	7 (-18)	15	
	(r)MMPALT	6 (0)	3.5 (2)	3.5 (2)	1.5 (3)	1.5 (3)	6 (0)	6 (0)	10	-.23
48	PMPS	1 (13)	4 (4)	6 (-5)	2 (12)	5 (- 4)	3 (5)	7 (-27)	-2	
	(r)MMPALT	5.5 (1)	5.5 (1)	3.5 (3)	1 (6)	2 (4)	3.5 (3)	7 (0)	18	.29
49	PMPS	4 (1)	6 (-12)	3 (6)	1 (20)	5 (- 7)	2 (8)	7 (-18)	-2	
	(r)MMPALT	3 (7)	5.5 (4)	5.5 (4)	1.5 (9)	1.5 (9)	4 (5)	7 (2)	40	.56
50	PMPS	5 (- 6)	1 (26)	3 (12)	4 (1)	7 (-21)	2 (17)	6 (-19)	10	
	(r)MMPALT	2.5 (6)	2.5 (6)	6.5 (0)	1 (7)	4 (2)	5 (1)	6.5 (0)	22	.13
51	PMPS	1 (19)	5 (- 1)	2 (15)	4 (1)	6 (- 6)	3 (5)	7 (-32)	1	
	(r)MMPALT	3 (3)	5.5 (2)	1 (5)	3 (3)	3 (3)	5.5 (2)	7 (1)	19	.60
52	PMPS	6 (-23)	3 (11)	2 (16)	4 (3)	5 (- 4)	1 (22)	7 (-28)	-3	
	(r)MMPALT	1.5 (6)	5 (1)	5 (1)	1.5 (6)	3 (2)	7 (0)	5 (1)	17	-.56
53	PMPS	1 (19)	4 (- 8)	6 (-14)	2 (6)	7 (-15)	3 (2)	5 (-13)	-23	
	(r)MMPALT	3.5 (4)	3.5 (4)	3.5 (4)	1 (7)	3.5 (4)	6 (1)	7 (0)	24	.24
54	PMPS	1.5 (18)	3 (10)	6 (-3)	1.5 (18)	5 (4)	4 (7)	7 (-34)	20	
	(r)MMPALT	5 (4)	2 (7)	4 (6)	2 (7)	2 (7)	6.5 (1)	6.5 (1)	33	.38

*revised

TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Total Score	Correlation
55	PMPS	3 (10)	3 (10)	1 (14)	5 (3)	6 (- 5)	3 (10)	7 (-18)	24	
	*(r)MMPALT	6.5 (0)	2 (4)	4.5 (1)	3 (2)	1 (5)	6.5 (0)	4.5 (1)	13	-.38
56	PMPS	1 (22)	3 (10)	4 (5)	2 (21)	6 (-23)	5 (- 7)	7 (-26)	2	
	(r)MMPALT	2.5 (7)	2.5 (7)	4 (6)	1 (10)	5.5 (4)	5.5 (4)	7 (3)	41	.93
57	PMPS	1 (33)	2 (15)	5 (-8)	4 (-3)	6 (- 9)	3 (- 2)	7 (-31)	-5	
	(r)MMPALT	3.5 (7)	6 (4)	2 (8)	1 (9)	3.5 (7)	5 (5)	7 (1)	41	.09
58	PMPS	6 (- 8)	4.5 (-1)	2 (10)	4.5 (-1)	3 (0)	1 (24)	7 (-36)	-12	
	(r)MMPALT	4 (3)	7 (1)	3 (4)	1 (7)	2 (6)	5.5 (2)	5.5 (2)	25	.15
59	PMPS	6 (- 9)	4 (-2)	3 (3)	5 (-6)	1 (20)	2 (8)	7 (-14)	0	
	(r)MMPALT	5 (1)	2.5 (2)	2.5 (2)	1 (4)	5 (1)	5 (1)	7 (0)	11	.17
60	PMPS	4 (2)	5 (-4)	2 (15)	3 (11)	6 (-18)	1 (30)	7 (-33)	3	
	(r)MMPALT	4 (5)	2.5 (6)	2.5 (6)	1 (9)	6 (3)	5 (4)	7 (1)	34	.52
61	PMPS	7 (-30)	6 (-9)	5 (-4)	4 (2)	2 (14)	1 (31)	3 (4)	8	
	(r)MMPALT	3 (5)	5 (4)	5 (4)	1.5 (7)	1.5 (7)	5 (4)	7 (0)	31	-.04
62	PMPS	5 (- 8)	4 (-4)	6 (-9)	2 (13)	3 (6)	1 (31)	7 (-34)	-5	
	(r)MMPALT	6 (5)	2 (7)	4.5 (6)	2 (7)	2 (7)	4.5 (6)	7 (1)	39	.62
63	PMPS	3 (- 6)	4 (-8)	1 (8)	2 (-5)	5 (- 9)	6 (-11)	7 (-15)	-46	
	(r)MMPALT	3 (5)	1.5 (8)	4 (4)	1.5 (8)	5 (3)	6.5 (1)	6.5 (1)	30	.71

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TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Inter-active	Visual	Haptic	Kines-thetic	Olfac-tory	Total Score	Correl-ation
64	PMPS	6 (-14)	4 (7)	2 (16)	3 (15)	1 (30)	5 (-9)	7 (-33)	12	
	*(r)MMPALT	3.5 (4)	5 (3)	3.5 (4)	1 (9)	2 (7)	6 (2)	7 (0)	29	.72
65	PMPS	1 (20)	3 (4)	6 (-6)	4 (0)	5 (-4)	2 (16)	7 (-20)	10	
	(r)MMPALT	6 (3)	4.5 (4)	2 (7)	1 (9)	3 (5)	4.5 (4)	7 (2)	34	-.13
66	PMPS	5 (3)	6 (-11)	3.5 (7)	3.5 (7)	2 (13)	1 (19)	7 (-21)	17	
	(r)MMPALT	6 (1)	2 (3)	3.5 (2)	1 (8)	6 (1)	3.5 (2)	6 (1)	18	.12
67	PMPS	5 (- 9)	6 (-15)	4 (2)	3 (6)	1 (33)	2 (22)	7 (-25)	14	
	(r)MMPALT	2 (6)	6 (2)	6 (2)	1 (8)	6 (2)	4 (3)	3 (4)	27	-.15
68	PMPS	6 (- 9)	4 (3)	5 (-4)	3 (9)	2 (10)	1 (22)	7 (-31)	0	
	(r)MMPALT	7 (0)	5 (2)	4 (3)	1 (9)	3 (4)	2 (5)	6 (1)	24	.82
69	PMPS	7 (-12)	4 (2)	2 (12)	5 (-8)	3 (6)	1 (18)	6 (-10)	8	
	(r)MMPALT	6.5 (0)	2 (4)	4 (2)	1 (6)	3 (3)	5 (1)	6.5 (0)	16	.27
70	PMPS	5 (- 3)	3 (3)	4 (-1)	2 (15)	6 (-9)	1 (19)	7 (-28)	-4	
	(r)MMPALT	5 (5)	1.5 (9)	3 (8)	1.5 (9)	5 (5)	5 (5)	7 (3)	44	.62
71	PMPS	1 (32)	3 (4)	2 (6)	4 (2)	5.5 (0)	5.5 (0)	7 (-36)	8	
	(r)MMPALT	1.5 (9)	4.5 (5)	4.5 (5)	3 (8)	1.5 (9)	6 (2)	7 (0)	38	.52
72	PMPS	4.5 (- 2)	3 (5)	2 (15)	4.5 (-2)	6 (-8)	1 (25)	7 (-33)	0	
	(r)MMPALT	7 (2)	2.5 (6)	4 (5)	1 (10)	2.5 (6)	5 (4)	6 (3)	36	.05

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TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element												Total Score	Correlation
		Print		Aural		Interactive		Visual		Haptic		Kinesthetic		Olfactory			
73	PMPS	7	(-27)	4.5	(2)	2	(9)	3	(7)	4.5	(2)	1	(24)	6	(-18)	-1	
	*(r)MMPALT	5	(2)	6	(1)	3.5	(3)	1	(10)	2	(5)	3.5	(3)	7	(0)	24	.53
74	PMPS	4	(3)	5	(0)	1.5	(22)	3	(7)	6	(-23)	1.5	(22)	7	(-35)	-4	
	(r)MMPALT	3	(3)	6.5	(0)	3	(3)	1	(5)	3	(3)	5	(2)	6.5	(0)	16	.42
75	PMPS	6.5	(-12)	5	(4)	2	(12)	3	(6)	4	(2)	1	(16)	6.5	(-12)	16	
	(r)MMPALT	2	(3)	5.5	(1)	3.5	(2)	1	(4)	3.5	(2)	7	(0)	5.5	(1)	12	-.17
76	PMPS	3	(7)	6	(-15)	4	(1)	1	(18)	5	(- 4)	2	(17)	7	(-26)	-2	
	(r)MMPALT	2	(7)	5	(5)	3.5	(6)	1	(10)	6	(4)	3.5	(6)	7	(3)	41	.90
77	PMPS	5	(- 5)	6	(- 6)	4	(2)	3	(9)	2	(13)	1	(19)	7	(-29)	3	
	(r)MMPALT	4	(6)	6	(4)	1.5	(8)	1.5	(8)	4	(6)	4	(6)	7	(1)	39	.58
78	PMPS	4	(7)	3	(19)	2	(20)	1	(29)	5	(-14)	6	(-21)	7	(-29)	11	
	(r)MMPALT	6.5	(2)	2	(8)	3	(6)	1	(9)	4	(4)	6	(3)	6.5	(2)	34	.81
79	PMPS	2	(16)	4	(2)	3	(8)	1	(22)	6	(-20)	5	(- 5)	7	(-24)	-1	
	(r)MMPALT	5	(5)	4	(6)	2	(8)	1	(10)	3	(7)	6	(3)	7	(1)	40	.64
80	PMPS	2	(11)	6	(- 8)	3	(1)	4	(-5)	1	(29)	5	(- 6)	7	(-32)	-10	
	(r)MMPALT	3	(6)	6	(3)	1.5	(7)	1.5	(7)	4	(4)	7	(0)	6	(2)	29	.56
81	PMPS	4	(- 1)	6	(-12)	3	(15)	5	(-10)	2	(18)	1	(20)	7	(-26)	4	
	(r)MMPALT	6	(1)	2.5	(6)	4	(5)	1	(9)	2.5	(6)	5	(3)	7	(0)	30	.11

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TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Total Score	Correlation
82	PMPS	4 (4)	5 (- 3)	1 (17)	6 (-11)	3 (11)	2 (13)	7 (-31)	0	
	*(r)MMPALT	4.5 (3)	6 (2)	2.4 (4)	1 (9)	4.5 (3)	2.5 (4)	7 (0)	25	.44
83	PMPS	2 (17)	1 (31)	4 (2)	3 (8)	5 (-11)	6 (-19)	7 (-27)	1	
	(r)MMPALT	4.5 (4)	2 (7)	3 (6)	1 (9)	4.5 (4)	6.5 (2)	6.5 (2)	34	.76
84	PMPS	5 (- 4)	6 (- 8)	2 (12)	3 (4)	1 (18)	4 (2)	7 (-18)	5	
	(r)MMPALT	2 (10)	5 (7)	2 (10)	2 (10)	4 (9)	6 (4)	7 (3)	63	.56
85	PMPS	5 (- 2)	4 (2)	3 (6)	1 (22)	6.5 (-16)	2 (20)	6.5 (-16)	16	
	(r)MMPALT	3 (7)	1 (10)	4 (6)	2 (8)	5 (4)	6 (3)	7 (0)	38	.40
86	PMPS	5 (- 6)	7 (-16)	4 (-2)	3 (6)	2 (12)	1 (16)	6 (-11)	-1	
	(r)MMPALT	5 (6)	3.5 (8)	3.5 (8)	2 (9)	1 (10)	6 (3)	7 (1)	46	.27
87	PMPS	1 (23)	2 (15)	5 (-4)	3.5 (6)	3.5 (5)	6 (- 9)	7 (-36)	-1	
	(r)MMPALT	3.5 (8)	2 (9)	5 (7)	1 (10)	3.5 (8)	6 (3)	7 (1)	46	.77
88	PMPS	3.5 (10)	2 (21)	1 (25)	3.5 (10)	5 (-10)	6 (-22)	7 (-28)	6	
	(r)MMPALT	2 (10)	4.5 (9)	4.5 (9)	2 (10)	2 (10)	7 (2)	6 (3)	53	.36
89	PMPS	7 (-29)	5 (- 4)	2 (14)	3 (10)	4 (- 3)	1 (15)	6 (-14)	-11	
	(r)MMPALT	6 (0)	3 (1)	6 (0)	6 (0)	1 (2)	3 (1)	3 (1)	5	.00
90	PMPS	3 (5)	4 (3)	5 (1)	2 (10)	6 (-14)	1 (12)	7 (-21)	-4	
	(r)MMPALT	5.5 (1)	1.5 (3)	3.5 (2)	1.5 (3)	3.5 (2)	5.5 (1)	7 (0)	12	.24

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TABLE X (Continued)

Subject Number	Measurement	Ranks (Scores) by Element: Print	Aural	Interactive	Visual	Haptic	Kinesthetic	Olfactory	Total Score	Correlation
91	PMPS	3 (8)	2 (12)	1 (16	4 (5)	5 (4)	7 (-15)	6 (-12)	18	
	*(r)MMPALT	4.5 (5)	2 (8)	4.5 (5)	1 (9)	3 (7)	6 (4)	7 (0)	38	.47
92	PMPS	2 (15)	6 (-14)	5 (-5)	4 (-3)	3 (3)	1 (35)	7 (-36)	-5	
	(r)MMPALT	5.5 (2)	7 (1)	4 (3)	1 (10)	2 (6)	3 (5)	5.5 (2)	29	.45
93	PMPS	7 (-11)	6 (- 9)	2 (10)	4 (3)	3 (8)	1 (18)	5 (- 2)	17	
	(r)MMPALT	6.5 (0)	4.5 (1)	4.5 (1)	1 (6)	2.5 (3)	2.5 (3)	6.5 (0)	14	.59
94	PMPS	5 (- 3)	6 (-11)	4 (-1)	2 (11)	3 (9)	1 (15)	7 (-30)	-10	
	(r)MMPALT	4 (7)	4 (7)	4 (7)	1.5 (9)	1.5 (9)	7 (1)	6 (2)	42	.17
95	PMPS	4.5 (2)	4.5 (2)	3 (6)	2 (12)	6 (-16)	1 (23)	7 (-19)	10	
	(r)MMPALT	6 (0)	2.5 (2)	4 (1)	1 (4)	6 (0)	6 (0)	2.5 (2)	9	-.01
96	PMPS	7 (-23)	2 (21)	1 (27)	4 (-2)	5 (- 8)	3 (14)	6 (-17)	12	
	(r)MMPALT	4.5 (1)	6.5 (0)	3 (2)	1 (4)	2 (3)	6.5 (0)	4.5 (1)	11	-.15

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VITA

Clarence Edwin Cherry, Jr., was born in Birmingham, Alabama, on October 2, 1936. He attended public schools in Alabama and Florida and was graduated from Fletcher High School, Jacksonville Beach, Florida in 1954.

After attending Jacksonville Junior College for one year he began a career with the Florida Air National Guard. He was an aircraft mechanic and crew chief for 15 years before transferring to the Tennessee Air National Guard and becoming an academic instructor. He has served as a teacher and instructional supervisor in communications, management, leadership, and general military studies at both the I.D. Brown Air National Guard Professional Military Education Center at Knoxville, Tennessee, and the United States Air Force Senior Noncommissioned Officers Academy at Gunter Air Force Station, Alabama.

He earned a Bachelor of Science degree (Summa Cum Laude) from Troy State University (Alabama) in 1975 and a Master of Science degree from The University of Tennessee, Knoxville, in 1977. He received the Doctor of Education degree in August, 1981. He holds memberships in Kappa Delta Pi and Phi Kappa Phi honor societies.

He has been married to the former Evelyn Fletcher since 1957, and they have two sons David Mark and John Edwin. They reside in Maryville, Tennessee.