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A Study of the Relationship of Cognitive Similarity to Communication Accuracy

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A STUDY OF THE RELATIONSHIP OF COGNITIVE SIMILARITY TO COMMUNICATION ACCURACY

by

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Shirley Cunningham Woodworth

TABLE OF CONTENTS

TABLES

FIGURES

CHAPTER I

THE PROBLEM

Statement of the Problem

The purpose of this study was to determine if the degree of match among the cognitive styles of teachers of selected sections of Interpersonal Communication I and the cognitive styles of students enrolled in those sections of Interpersonal Communication I related to accuracy of communication.

First subproblem

The first subproblem was to determine the cognitive style of the teachers and students in each of the selected sections of Interpersonal Communication I as measured by the Cognitive Style Mapping Interest Inventory Test.

Second subproblem

The second subproblem was to determine the degree of match between the cognitive maps of the teachers of selected sections of Interpersonal Communication I and the cognitive maps of the students enrolled in those sections as determined by a matching procedure suggested by Dr. Joseph E. Hill, founder of the American Educational Sciences Association.

Third subproblem

The third subproblem was to determine the degree of communication accuracy between teachers and students in the selected sections of Interpersonal Communication I as measured by the students' performance on a communication exercise.

Fourth subproblem

The fourth subproblem was to analyze and to interpret the treated data so as to evaluate the relationship of cognitive style match to communication accuracy.

Importance of the Study

To state that a study which might advance our understanding of the process of communication is important is to state the obvious. Human interaction is carried out through the process of human communication. There is no other mode. This study is important then, because it can contribute to an understanding of the communication process. This was the general purpose of the study.

The specific importance of this study lies in its contribution to the research and developing theory which relates cognitive similarity to communication accuracy. Mehrabian and Reed (1968) report:

> A survey of the literature on verbal and nonverbal communication reveals a surprising neglect of the direct study of the problems of communication accuracy (p. 365).

Up to the present there have been only a few studies whose purpose has been to examine the problem of communication accuracy. However,

several of the existing studies do suggest that there is a relationship between cognitive similarity of communicator and addressee and communication accuracy.

The concept of communicator-addressee similarity, or homophily, as a factor in communication effectiveness is a generally accepted principle in communication theory. The tendency to admit and to accept messages or communications from those communicators who are perceived as similar or being "like" the addressee has been widely researched. Several theoretical models, commonly called 'Cognitive Models', have been developed. These models attempt to explain the cognitive process in communication effectiveness in terms of balance (Heider, 1946), co-orientation (Newcomb, 1953, 1956), congruity (Osgood and Tannenbaum, 1955), and dissonance (Festinger, 1957). These theories and models of cognitive similarity differ from the one used in this study in that in general, such prior work has focused upon attitude similarity. At this time the writer has found no study which has used any direct measure of cognitive similarity as a variable in assessing communication accuracy. In the prior studies which have attempted to measure the effect of cognitive similarity on communication accuracy, cognitive similarity has been inferred from some other measure of similarity, commonly attitudinal similarity.

Triandis (1960), in a study of cognitive similarity and communication effectiveness states that if communication theorists and researchers are to develop a theory to explain the relationship of cognitive similarity and communication effectiveness-accuracy, the meaning of the term 'cognitive similarity' must be clarified and

specified.

The Cognitive Style Interest Inventory Test was developed by Hill and his associates in the American Educational Sciences Association. The Inventory provides a more direct measure of cognitive similarity than can be obtained from routines which infer cognitive similarity from some other measure. The cognitive style instrument is predicated on the same assumptions which undergird the Educational Sciences as a whole. These assumptions are:

1. Education is the process of searching for meaning.
2. Thought is different from language.
3. Man is a social creature with a unique capacity for deriving meaning from his environment and personal experiences through the creation and use of symbols.
4. Not content with biological satisfactions alone, man continually seeks meaning (Hill, 1968, p. 2).

Cognitive style is defined by the Educational Sciences as the way in which an individual gets meaning from his world. The Cognitive Style Interest Inventory Test is an instrument which indicates the individual's characteristic preferred manner of getting meaning from his environment.

> An individual's cognitive style is determined by the way he takes note of his total surroundings--how he seeks meaning, how he becomes informed. Is he a listener or a reader? Is he concerned only with his own viewpoint or is he influenced in decision-making by his family or associates? Does he reason as a mathematician, or as a social scientist, or as an automotive mechanic? (Hill, 1968, p. 3).

An individual's cognitive style can be graphically represented as a cognitive map which is a "picture" of the ways in which the individual

acquires meaning. A cognitive map is presented in the form of a cartesian product of three sets. The three sets are symbols and their meanings, cultural determinants, and modes of inference. The first set, symbols and their meanings, is composed of theoretical and qualitative symbols. The theoretical symbols are of two types: auditory and visual each of which is divided into linguistic and qualitative elements. Qualitative symbols are of three types: qualitative symbols associated with sensory stimuli, qualitative symbols which are programmatic, and qualitative symbols associated with cultural codes.

The second set, cultural determinants, is composed of three determinants of the meanings of symbols: individuality, associates, and family. The third set, modalities of inference, is composed of five methods of reasoning: magnitude, difference, relationship, appraisal, and deductive. The process of cognitive style mapping is summarized as follows:

> Cognitive maps are printed out in the form of a cartesian product of three sets. The first set indicates a student's tendency to use certain types of symbols, his ability to understand words and numbers, qualitative sensory symbols, qualitative programmatic symbols, and qualitative codes. The second set indicates influences which the student brings to bear in deriving meaning from symbols. These influences are effected mainly in terms of his own individuality (I), or his associates' (A) perceptions, or those of his family (F). The third set indicates the manner in which he reasons, or the way in which he infers. Whether he thinks in categories (M), or in terms of differences (D), or synthesizes multiple relationships (R), or uses all three (L), his modality of inference influences, and is influenced by, symbols and the cultural determinants he employs in his style. These three sets of elements, i.e., symbolic mediation, cultural determinants, and modalities of inference, comprise the cognitive style of the individual. (Hill, 1968, p. 3).

This study then, is of importance because it is an effort to use the Cognitive Style Mapping Interest Inventory Test, which is gaining acceptance as a direct measure of cognitive similarity, to determine if similarity of cognitive style is related to communication accuracy.

Delimitations

This study does not attempt to determine if any particular cognitive style is more effective than any other cognitive style in creating communication accuracy.

The study does not attempt to determine the specific function of feedback in communication accuracy.

The study does not attempt to determine if teachers of Interpersonal Communication I possess similar cognitive styles.

The study is limited to determining if accuracy of communication between teachers and students in selected sections of Interpersonal Communication I is related to similarity of cognitive profiles.

Definition of Terms

1. Cognitive Style is defined by the Educational Sciences as the way in which a person gathers information and obtains meaning from that information.

2. Cognitive Map is a written representation of an individual's cognitive style, divided in terms of major, minor, and null elements of style.

3. Degree of Match is the degree to which two individual's cognitive maps are similar.

Operationally, degree of match is defined as the percentage of match between two cognitive maps as determined by a matching routine suggested by Dr. Joseph E. Hill.

4. Communication Accuracy:

> Communication accuracy is defined as the degree of correspondence between the referents decoded, or inferred, from a set of communication behaviors by an addressee and the referents encoded, or represented, in those communication behaviors by the communicator (Mehrabian and Reed, 1968, p. 365).

Operationally, communication accuracy is defined as a score that a student receives on the communication accuracy exercise.

Assumptions Underlying Study

1. The first assumption is that the Cognitive Style Mapping Interest Inventory Test is a valid measure of cognitive style.

2. The second assumption is that the matching procedure used to determine the degree of cognitive match between two cognitive maps is a valid procedure.

3. The third assumption is that the communication accuracy exercise will provide a measure of communication accuracy.

Questions To Be Answered

The general question to be answered by this study is: Is similarity of cognitive style, as measured by the Cognitive Style Mapping Interest Inventory Test related to accuracy of communication? Stated more precisely, the purpose of this study is to answer the following questions:

1. Is there any difference between those students who have

a high degree of cognitive match with their teacher and those students who have a moderate degree of cognitive match with their teacher in their scores on the communication accuracy exercise at three different levels of complexity?

2. Is there any difference between those students who have a high degree of cognitive match with their teacher and those students who have a low degree of cognitive match with their teacher in their scores on the communication accuracy exercise at three different levels of complexity?

3. Is there any difference between those students who have a moderate degree of cognitive match with their teachers and those students who have a low degree of cognitive match with their teacher in their scores on the communication accuracy exercise at three different levels of complexity?

Overview

Chapter I - Introduction of the problem

The statement of the problem, importance of the problem, definitions of terms, questions to be answered, assumptions underlying the study delimitations, and a short overview have been provided.

Chapter II - Review of the related literature

Literature related to the Educational Science of cognitive style and to communication accuracy have been reviewed.

Chapter III - Research design

The chapter contains the source of the data, methods of

gathering data, and the instrumentation employed in the study.

Chapter IV - Analysis of results

In the analysis of results chapter has been included a description of the analytical technique used and tables showing the results of the analysis of data and findings related to the questions.

Chapter V - Summary and conclusions

Questions are answered, conclusions are drawn, discussions are made, and suggestions for future research are proposed in this chapter.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The review of the related literature is focused upon communication accuracy and cognitive style as the concept was developed by the American Educational Sciences Association. The general area of communication effectiveness, which though related to communication accuracy, is outside the scope of this study as is the general area of cognitive development.

The following review of the related literature has been partitioned into four divisions: (1) the Educational Sciences, including the development of the construct of cognitive style; (2) research utilizing the construct of cognitive style as it relates to the educational setting; (3) research on communication; and (4) research on the relationship between attribute similarity of communicator-addressee and communication accuracy.

The Educational Sciences

The Educational Sciences were developed as a result of a felt need to provide the discipline of education with the conceptual frameworks, languages, and patterns and structures of knowledge which would give to the study of education the ability to communicate with a precision like that of the academic disciplines and the professional

fields. Hill (1968) explains the need for such a conceptual framework:

> Without the needed framework and language, the field of education does not readily lend itself to meaningful description or definition. The inherent difficulty, therefore, is not that educators find it extremely difficult to communicate, but that the possibilities of misinterpretation and misunderstanding are great and that the probability of relatively precise discriminations and predictions is small (p. 2).

Thus the Educational Sciences have been created as a structure within which:

> . . . inquiry of significance for the fundamental aspects of the applied field of education can be conducted. The Educational Sciences provide a conceptual framework and scientific language for the applied field of education that approaches the level of precision found in such derivative fields as medicine, pharmacy, engineering, law, and nursing (Svagr, 1973, p. 1).

There are four assumptions which are essential to the conceptual framework for education called the Educational Sciences:

1. Education is the process of searching for meaning.
2. Thought is different from language.
3. Man is a social creature with a unique capacity for deriving meaning from his environment and personal experiences through the creation and use of symbols.
4. Not content with biological satisfactions alone, man continually seeks meaning (Hill, 1968, p. 2).

Hill (1967) credits the contributions of several philosophers and educators whose work provide support and rationale for the assumptions of the Educational Sciences.

> In recent decades thinkers with widely different orientations have conducted rigorous inquiries into the problem of meaning and many of these efforts have had significant influences on the understanding of this phenomenon. Outstanding in this group would be such names as A. J. Ayer, Boris Carnap, Ernst Cassirer, John Dewey, Lawrence Frank, Alfred Korzybski, George

> Moore, V. C. Morris, Karl Nagel, K. V. Neurath, Charles Ogden, Charles Pierce, D. W. Richards, Bertrand Russell, Victor Tarski, Alfred North Whitehead, and Ludwig Wittenstein (p. 1).

The Educational Sciences as thus conceptualized are comprised of seven sciences considered to be fundamental to the educative process. The seven educational sciences are:

1. Symbols and their meanings
2. Cultural determinants of the meanings of symbols
3. Modalities of inference
4. Biochemical and electrophysiological aspects of memory-concern
5. Cognitive styles of individuals
6. Teaching styles, administrative styles and counseling styles
7. Systemic analysis decision-making (Hill, 1968, p. 2).

It has not been the author's purpose to develop a detailed history of the Educational Sciences, but rather to provide a general framework for the understanding of the Educational Sciences. The present study is concerned with four of the educational sciences: symbols and their meaning; cultural determinants of the meaning of symbols; modalities of inference; and cognitive style. This fourth science, cognitive style, is a separate educational science which has drawn upon the knowledges gained from the other three.

Cognitive Style

The concept of cognitive style as developed by the Educational Sciences pertains to an individual's cognition or awareness. Stated simply, cognitive style refers to the way in which an individual derives meaning from his world.

> An individual's cognitive style is determined by the way he takes note of his total surroundings--how he

seeks meaning, how he becomes informed (Hill, 1968, p. 3).

Practitioners in the Educational Sciences distinguish cognitive style from learning styles as presented in the work of those such as Hull, Tolman, and Watson (Svagr, 1974, p. 1).

Cognitive style is further distinguished from the concept as it is defined in the field of psychology.

> The construct of cognitive style, which was developed as one of the educational sciences is different from those defined in the field of psychology. Employing a modified form of Guttman's (1954-55, 1959) meta-theory of facets as a model, the concept of cognitive style is defined as the cartesian product of the following four sets: (1) symbols and their meanings, (2) cultural determinants, (3) modalities of inference, and (4) memory-concern (Berry and Sutton, 1973, p. 6).

The first set, symbols and their meaning, contains two basic types of symbols--theoretical (words and numbers) and qualitative (sensory and code data).

> The theoretical symbol is that symbol which presents to the awareness of the individual something different from that which the symbol itself is. The qualitative symbol is that symbol which presents and then represents to the awareness of the individual that which the symbol itself is to that individual (Hill, 1968, p. 4).

Four theoretical symbols have been identified by the Educational Sciences.

1. The Theoretical Auditory Linguistic (T(AL) symbol is the sound of a word or onomatopoeia.

2. The Theoretical Auditory Quantitative T(AQ) symbol is the sound of a number.

3. The Theoretical Visual Linguistic T(VL) symbol is the written word.

4. The Theoretical Visual Quantitative T(VQ) symbol is the

written number.

Meanings for the qualitative symbols are derived from three sources: sensory stimuli, cultural codes (games), and programmatic effects of phenomena which convey an impression of a definite series of images, events or operations (Hill, 1968, p. 4). Sensory stimuli are not generally used when deriving collective cognitive style or in the matching of styles, but since they are important in determining cognitive style an explanation of these symbols is included.

1. An example of the Qualitative Auditory Q(A) symbol is the sound of music or the clang of metal on metal.

2. An example of the Qualitative Olfactory Q(O) symbol is the smell of flowers or frying bacon.

3. An example of the Qualitative Savory Q(S) symbol is the tart taste of lemon or the sweet taste of peach.

4. An example of the Qualitative Tactile Q(T) symbol is the smooth feel of silk or the rough feel of corduroy.

5. An example of the Qualitative Visual Q(V) symbol is the color of the setting sun or a drawing of a floor plan.

There are ten qualitative symbols associated with cultural codes.

1. Qualitative Code Empathetic Q(CEM) is the ability to put yourself in another's place and to see things from his point of view.

2. Qualitative Code Esthetic Q(CES) is the ability to enjoy the beauty of an object or an idea (i.e., a painting, surroundings, or a well-turned phrase).

3. Qualitative Code Ethic Q(CET) is a commitment to a set of

values, a group of principles, obligations and/or duties (this does not imply morality).

4. Qualitative Code Histrionic Q(CH) is the ability to deliberately stage behavior or play a role to produce a desired effect on others.

5. Qualitative Code Kinesics Q(CK) is the ability to understand or to communicate nonverbally--body motions, smiles, hand gestures.

6. Qualitative Code Kinesthetics Q(CKH) relates to motor skill abilities--bowling or golfing according to accepted form.

7. Qualitative Code Proxemics Q(CP) is the ability to judge the "critical" physical and social distance between oneself and another person--being able to recognize if you can touch another person or draw a chair nearer to him.

8. Qualitative Code Synnoetics Q(CS) is personal knowledge of oneself--realistic assessment of abilities and the setting of realistic goals.

9. Qualitative Code Transactional Q(CT) is the ability to influence the actions and/or goals of others--persuasiveness.

10. Qualitative Proprioceptive Q(P) is the ability to combine or coordinate several qualitative symbols into a specific function or activity, such as running to and catching a baseball or typing from written copy.

The second set in the construct of cognitive style is that which deals with the cultural determinants of the meanings of symbols. There are three cultural determinants of the meaning of symbols: individuality, associates, and family. An individual interprets the

theoretical and qualitative symbols in relation to roles that place expectations upon him. The Educational Sciences consider the perception of theoretical and qualitative symbols to be influenced by:

1. Associates (A)--an individual's peers, associates, and various groups with whom the person has the greatest contact and which change throughout his lifetime.

2. Family (F)--either immediate or extended which tend to establish guidelines, principles, values for determining behavior.

3. Individuality (I)--the individual's awareness and acceptance of the ways in which he is different from others.

The third part of cognitive style is the educational science of modalities of inference. The meanings of symbols are influenced by the characteristic modes of inference, i.e., patterns of thinking which an individual uses. There are two principle patterns of thought: the inductive process which provides a conclusion based upon specific incidents, and the deductive process which reasons from a general principle to the specific incident.

There are four inductive inferential processes which are defined as:

1. Magnitudes (M)--a form of "categorical reasoning" that uses norms and definitions.

2. Differences (D)--or making comparisons or contrasts of selected characteristics or traits.

3. Relationships (R)--the synthesizing of a number of characteristics or traits into a unified meaning or the analysis of a situation to determine its component parts.

4. Appraisal (L)--the modality of inference employed by a person who uses the modalities of Magnitudes, Differences, and Relationships equally in his reasoning process.

The deductive element (K) is the type of reasoning or logical proof used in geometry and syllogistic reasoning. (K) is indicated on an individual's cognitive style map, but is not used to determine collective cognitive styles or the matching of styles.

The fourth set in the construct of cognitive style is the science of memory-concern. The memory function is complex and at the present time there is a lack of an adequate conceptual framework to permit its inclusion in the mapping of cognitive styles (Hill, 1968, p. 14).

Cognitive style is the cartesian product of appropriate elements drawn from the three sets: symbols and their meanings, cultural determinants of the meanings of symbols, and modalities of inference.

Cognitive style is a diagnostic measure which can be used to help individuals select activities in which they have a high probability of success. This diagnostic procedure has applications for students, teachers, counselors, administrators, educational tasks and materials, and for occupations. The premise is that if an individual selects, or is helped to select, those tasks, materials, and situations which require the utilization of cognitive behaviors which are within his characteristic preferred cognitive style that individual will have a greater probability of success.

Research Utilizing the Educational Science of Cognitive Style

The development of the construct of cognitive style has permitted researchers, primarily doctoral students, to look at several of the components of the educational setting, e.g., teachers, students, administrators, curricula, teacher evaluation, and course achievement, for the purpose of studying the relationship of individual or collective cognitive styles to these elements.

Collective cognitive styles have been found to exist for groups such as administrators (Zussman, 1968), "successful" teachers (Dehnke, 1966), students (Blanzy, 1970) with positive and negative attitudes, and "successful" directors of community education (Niles, 1974). While such findings are of interest within the educational setting, the identification of collective styles for teachers or students of interpersonal communication was not the purpose of this paper.

A group of studies which have used the construct of cognitive style has indicated that similarity or dissimilarity of cognitive style is related to evaluations. DeLoach (1969) carried out a study which was predicated on the assumption that in a situation in which teacher and administrator-evaluator had disjunct cognitive styles, cognitive dissonance, as theorized by Festinger (1957), would be created. The study was designed to answer the following question:

> Will correlation (high to low similarity continuum) of administrator and instructor cognitive styles (as defined in the educational sciences) act as a significant variable in the administrator's evaluation of the instructor? (DeLoach, 1970, p. 11).

DeLoach matched instructors with administrators-evaluators on the basis of the number of binomial combinations in their respective styles which they held in common, e.g., T(AL)+Q(CES) or T(VL)+Q(CET). Each evaluator then observed and evaluated two or three of the instructors with whom he had the greatest number of binomial combinations in common and two or three instructors with whom he had the least number of binomial combinations in common. The evaluation scores were then analyzed and the following results were reported. The group of instructors and evaluators with high similarity of cognitive style had a mean evaluation score of 79.74 with a standard deviation of 11.57. The group of instructors and evaluators with a low similarity of cognitive style had a mean evaluation score of 61.11 with a standard deviation of 21.23. The *t*-ratio for these two means was 2.16 which was significant beyond the five percent level (DeLoach, 1970, p. 12). The question then, of the relationship between cognitive style and evaluations was answered affirmatively.

Studies by Blanzy (1970) and Schroeder (1969) which were similar in conceptualization, examined the relationship between student and teacher cognitive styles and student-derived teacher evaluations. They report that students with a cognitive style similar to that of their teacher tended to rate their teacher as very effective, while those students whose cognitive style was unlike that of their teacher gave their teacher less positive ratings. It is interesting to note that based upon the populations sampled for these studies, that the phenomenon of teacher evaluations being rated to the cognitive similarity between

teacher and student seems to exist at both elementary and college levels.

Another group of studies which employed the construct of cognitive style has shown that cognitive and/or similarity of cognitive style may be related to academic achievement. Hoogasin (1970) performed an experiment in which he attempted to discover if students' grades in college English courses were related to their cognitive style. Hoogasin collected data on 472 freshman students enrolled in English 151-English 152 sequence at Oakland Community College during the 1969-1970 school year. The data were used to determine collective cognitive style profiles for various letter grades earned by the students in their English course. The collective maps were then analyzed to determine if they could be used to predict the final letter grade a student is likely to earn. Hoogasin suggests that collective cognitive styles could be identified and related to various final letter grades, and that while the findings do not permit the prediction of precise letter grades that the cognitive styles were useful as gross predictors of success or failure in the courses under consideration.

The question of the relationship between cognitive styles and the grades which students receive has been studied (Wasser, 1969; Schroeder). Wasser's study was with elementary school children. One may note that even with young children a positive relationship exists between the grades which students earn and the degree to which their style is similar to that of their teacher. Students whose style is similar to the style of the teacher have a greater

probability of receiving a higher grade. Schroeder's (1969) study, noted earlier, establishes this same trend for college students.

These studies which have looked at cognitive style and grading are of particular interest because, as noted later in this chapter, course grades have been used as measures of communication accuracy.

Some studies have looked at the possibility of using only selected sets and elements of the cognitive style profile to predict academic achievement and curricular choice (Cotter, 1970; Grasser, 1973; Ort, 1971). Grasser attempted to determine if there are significant relationships between selected elements of cognitive style and grades which students received in algebra; Grasser employed a complex multivariate analysis procedure which looked at several measures of student achievement in algebra and at their relationship to several selected elements of the cognitive style profile, however, he summarizes his findings thus:

> Basically, it was determined that the "dropouts" in elementary algebra (H.S. equivalent grade 9) are significantly different from the highly successful students "A's" on many cognitive style abilities. In particular on aptitude, verbal reasoning, auditory linguistic, visual quantitative, reading level, auditory quantitative, English placement, ethic (dedication to a task accomplishment), individuality (independent learners), and appraisal (flexibility in arriving at inferences-inductive). All of the above favored the "A" group (Grasser, 1974).

Studies of the type conducted by Grasser suggest that there might be situations when it would be possible to use only selected elements of the cognitive style profile to predict student success

in selected areas. Ort (1971), however, in an examination of the relationship between the measurable cognitive characteristics of a French teacher and the success of students in the course reports that one must use information from three sets and not just one to predict course grades. In this study an attempt is made to consider all elements of the cognitive style profile which are normally considered when a matching procedure is carried out.

This group of studies which has employed the cognitive style instrument in educational situations indicates that the cognitive style profile and cognitive mapping may have useful applications in the educational situation. Collective cognitive styles can be determined for selected groups of individuals within the educational setting. The similarity of dissimilarity of cognitive styles has been found to be significantly related to administrator evaluations of teacher, student evaluation of teachers, and to student achievement as measured by course grades.

Research on Communication Accuracy

The complex process of human communication is at the very heart of all human enterprise. It is not surprising, therefore, to discover that in almost every arena of human endeavor we find emphasis placed upon the need for "effective communication". Few people would question the need for effective communication. The problems arise for the communication theorist or practitioner when he/she attempts to assess or to practice effective communication. This problem grows

out of the fact that the statement "communication effectiveness" is deceptively simple. McCroskey, Larson and Knapp (1971) state that too often communication effectiveness is regarded as a "single-faceted" (p. 15) phenomenon and that in practice:

> There is a wide range of outcomes any one of which might warrant the judgment that communication between two people has been "effective." In some cases communication will have been effective if the individuals involved have arrived at a greater mutual understanding of attitudes, sentiments, opinions, etc. In other situations communication will have been effective if the attitudes or beliefs of one or both parties change as a consequence of the interpersonal encounter. In still other situations we are interested primarily in being liked or evaluated favorably by another (p. 15).

McCroskey, Larson and Knapp state that there are three principal outcomes of communication:

> . . . accuracy (the extent to which two people understand each other), attraction (the extent to which two people like each other), and influence (the extent to which attitudes and beliefs are changed by the communication encounter) (p. 15).

For the purpose of this study the review of the literature has been limited to those studies specifically designed to investigate the phenomenon of communication accuracy.

Mehrabian and Reed's (1968) review of research on communication accuracy states: "Studies which have some bearing on communication accuracy emerge from diverse areas and are interpreted within unrelated frameworks" (p. 365). Festinger's (1957) study of erroneous inferences made as a result of the creation of dissonance on the part of the receiver is such a study. Cooper and Jahoda (1947) investigated the responses of prejudiced persons to anti-prejudiced messages. It was found that persons lacking in prejudice could easily

explain the point of the cartoon used to carry the message, whereas those persons who were prejudiced usually missed the point of the message. Cooper and Jahoda concluded that prejudiced persons "prefer not to face the implications of ideas opposed to their own . . . . What they do is to evade the issue psychologically by simply not understanding the message" (pp. 15-16). Mehrabian and Reed (1968) conclude that while studies of this nature do have some relationship to the phenomenon of communication accuracy, the relationship is not clearly defined (p. 365).

Mehrabian and Reed (1968) have identified five sets of variables which are determinants of communication accuracy: attributes of the channels, attributes of the communication, attributes of the referent, attributes of the communicator, and attributes of the addressee. This review of the literature will look at each of these five sets of variables, with the attributes of communicator, and addressee being conceptualized as similar and treated separately.

Attributes of the channels

The accuracy of communication, that is the degree to which the message is accurately decoded, appears to be related to the number of channels by which the message is carried. A message which is transmitted through multiple channels creates redundancy. As redundancy increases, the probability of inaccurate decoding decreases. One measure of communication accuracy which has been employed in prior research is the articulation test. Such tests involve having a discrete message, such as a single syllable or word transmitted to

the receiver. What the receiver then decodes-reports is viewed as a measure of communication accuracy (Eagan, 1948; and, Eagan, Clarke, and Careterette, 1956). While such tests may be legitimately regarded as tests of communication accuracy, they are perhaps more accurately defined as tests of auditory acuity and discrimination.

Studies by Neely (1966) and Sumby and Pollack (1954) which were essentially articulation tests of the type reported by Eagan and Eagan, Clarke, and Careterette, indicate that when the receiver can see the lips of the communicator at the same time that he hears the verbal transmission of the syllable or word which is being communicated, communication accuracy-intelligibility is increased.

At a given time a communicator may be using several communication channels simultaneously. Verbal utterances, facial expression, vocal variety, vocal emphasis, posture, and frequency and duration of eye contact are some of the various channels which a speaker may employ during the transmission of only one simple message. One need not be a communication theorist to recognize that if inconsistent messages are simultaneously transmitted, accuracy of decoding is negatively influenced. Mehrabian and Wiener (1967) and Mehrabian and Ferris (1967) report that when inconsistent attitude messages were transmitted in the facial, vocal, and verbal channels that the blocking of the facial and vocal channels resulted in considerable alteration in the quality of the attitude being communicated.

Another characteristic of the channel in the communication process is the availability of feedback. The term "feedback" is commonly used to refer to any response on the part of the receiver in the communicative act. Communication theorists, however, define

the term more exactly. In its strictest interpretation feedback is defined as a portion of the message which returns to the source and causes some modification or adaptation in subsequent message transmission. Thus, feedback functions to regulate the output of the system.

In human communication feedback is defined as any response of the listener which tells the communicator how his message is being received. Such a response, verbal or nonverbal, is called meta-communication, or in other words, communication about the communication. For such meta-communication or response to be considered feedback it must have an effect upon the speaker's subsequent behavior. Thus, any response which a listener may make is not defined as feedback. Feedback must be a response which tells the speaker how the message is coming across and permit him to modify his behaviors appropriately.

An understanding of the function of feedback leads us to suspect that adequate levels of feedback contribute to accuracy in communication, for with adequate feedback, the encoder can alter subsequent transmissions of a message to the end of correcting inaccurate decoding. Leavitt and Mueller (1951) conducted two studies of the effects of feedback on communication which have become classic studies. Leavitt and Mueller's studies are of particular significance because they employed a modification of a communication game strategy which is similar to that employed in the present study.

The first study required a class instructor to describe

abstract geometric patterns to students who then had to reproduce the patterns relying solely on the verbal description which they had heard. Two instructors and four groups of students were used. The task was carried out under four degrees of feedback: (1) a zero feedback condition, in which the instructor was concealed behind a portable blackboard, in which no questions were permitted from the students, and in which the students were not permitted to make any sounds; (2) a visible audience condition, in which the students and teacher could see each other but could not talk; (3) a "yes-no" condition, in which the participants could see each other and students could respond with either yes or no in response to questions from the instructor; and, (4) a free feedback condition, in which students could ask questions, interrupt, etc.

All students were given the same instructions at the start of their class period. They were told that the exercise was a test of their ability to follow directions, that they were to work as quickly and accurately as possible. Each of the instructors involved in the exercise had had some prior experience in describing patterns similar to those used in the exercise, and had been involved in the construction of the patterns used in the exercise. In addition to producing the patterns the students were asked to estimate the degree of accuracy they had achieved in producing the designs. As a final measure, the description of each pattern was timed.

The students' papers were scored for accuracy and the mean accuracy scores determined. Leavitt and Mueller reported that, "The mean accuracy score for all patterns increased steadily from zero to

free feedback" (p. 404); but, they reported no test to determine any significance of difference. The report of this first test also states that students' estimates of their accuracy in producing the shapes was closely related with actual accuracy; but, no test to determine the degree of correlation was reported. The mean time required to give the instructions under the four conditions of feedback increased from 229 seconds under the zero feedback condition to 363 seconds under the free feedback condition. "Any decrease in time with experience is once again obscured by differences in difficulty" (p. 405).

The first experiment raised a number of questions which Leavitt and Mueller attempted to answer in a second set of experiments. Some of those questions were: Is the free feedback method more effective simply because it takes more time? Is there just as much improvement after a series of experiences without feedback as with feedback? and, Is there a continuous improvement in the course of several trials without feedback? (p. 405).

In the second series the purpose was to compare the two conditions, free feedback and zero feedback, over a longer series of trials. The task of the second experiment was the same as for the first. Ten instructors and ten groups of students were used for the second experiment, but only the two extremes of feedback levels were utilized. Again the descriptions were timed and students were asked to express confidence levels.

Leavitt and Mueller reported that the second experiment reflected the same trend as the first in that the difference between the mean

scores for the zero feedback condition and the free feedback condition were significant at the 1% level (p. 406). There is no report of the test used to determine significance. As in the first study the student's level of confidence correlated with actual accuracy. The authors stated that the difference in mean estimates of accuracy between the two conditions was significant, but again no indication of how the significance was determined.

Leavitt and Mueller attempted to provide some answers for the questions raised by their first study. The free feedback condition does seem to require more time than the zero feedback condition, but there is the suggestion that over repeated trials the time required for the free feedback condition is reduced. In response to the questions about the zero feedback condition the authors reported that there is improved accuracy with this condition over a number of trials. "The fourth zero feedback pattern is almost always more accurately sent than the first" (p. 409). It is interesting to note that Leavitt and Mueller conclude that sender experience contributes more to accuracy than does listener experience (p. 410).

The Leavitt and Mueller studies are of major significance to the present study in that the paradigm which they used is closely related to that of the present study. The present study differs from that of Leavitt and Mueller in that the role of feedback in the creation of communication accuracy is explicitly delimited. Leavitt and Mueller suggest that factors other than feedback may be responsible for some of the result which they report. No one with any understanding of the communication process would deny that the

utilization of feedback can increase communication accuracy. The present study attempts to examine the possibility that the cognitive element of similarity may also increase communication accuracy. As Leavitt and Mueller have reported some of the differences which they found were obscured by the differences in difficulty of the various patterns to be reproduced. The present study has incorporated a complexity factor into the design of the experiment which may permit differences in decoding accuracy to emerge more distinctly. Finally, where Leavitt and Mueller permitted some of their communicators to be familiar with the patterns prior to the administration of the exercise, in the present study no communicator saw any of the designs prior to the actual administration of the exercise.

Attributes of communication

Human communication is a highly complex process. The interrelated and interdependent nature of the process creates problems when an attempt is made to arbitrarily categorize its components for the purposes of analysis or discussion. This difficulty is evident when we attempt to look at the nature of the communication itself without reference to the situation in which the communication occurs. In such a context the communication must be viewed without regard for the communicators, the channels used, or the referents employed. Because of the difficulty of conceptualizing human communication in such a context, there have been only a very few attempts to assess the impact of the communication itself on communication accuracy.

Abrams (1966) surveyed the research on the relationship of structure of verbal communication to comprehension. He reported that the findings appear to be contradictory. Such studies have looked at sentence length, word order, placement of phrase, and similar items of structure and syntax. Miller, Heise, and Lichten (1951) reported that words which are spoken in isolation are more difficult to perceive than are the same words when they appear in the context of a sentence.

Lantz and Stefflre (1964) conducted a study which was concerned with the relationship between language and communication accuracy. One group of college undergraduates was asked to identify, name, a series of colors which were shown to them on color chips. Next, a second group of students was asked to identify the chips from the color descriptions which had been encoded by the first group. Communication accuracy was determined by comparing the degree of accuracy with which the decoders could refer back to the color the encoder had described (p. 4). Lantz and Stefflre report that communication accuracy did not correlate positively with naming agreement or brevity of description. Their statement about the lack of positive correlation between communication accuracy and naming agreement is of interest because it seems to contradict our common assumptions about language similarity and communication accuracy.

> It had previously been assumed that commonality in verbal response reflected ease and accuracy in communication. The fact that naming agreement and communication accuracy were not highly positively correlated demonstrates that this assumption is not justified (p. 480).

Attributes of the referent

Communication which is carried out in the verbal mode makes use of symbols. Symbols have meaning only as they refer to some referent separate and distinct from the symbols themselves. The word-symbol "dog" has no meaning in and of itself. The word-symbol "dog" has meaning only as it refers to a species of mammal, or to a particular domesticated pet. Communication accuracy appears to be related to two characteristics of referents: the degree or amount of ambiguity in the referent, and the complexity of the referent.

In a group experiment examining the effect of ambiguous referents upon coding behavior (Macy, Christie, and Luce, 1953), it was determined that communication accuracy was greatly reduced when the referent was ambiguous. The task of the study required groups of students to identify colored marbles. The referents were marbles of various colors and the content to be communicated was the marbles' colors. When the referent was a solid colored marble the average rate of error was 10%; however, when the referent was a mottled, cloudy, or indistinct color the average rate of communication error was approximately 50%.

Miller (1951) and Miller, Heise, and Lichten (1951) reported studies which bear upon the complexity of the referent and its relationship to communication accuracy. The task was for the subject to identify--decode a number which he was to hear. When the subject was told that the number which he would hear would be one of two possible numbers, i.e., 1 or 2, he was more accurate than when he was told that the number which he would hear was one of ten possible

numbers, i.e., 1, 2, 3, . . . 10. Miller wrote that the complexity of a referent is ". . . a linear function of the amount of information. As the number of alternative stimuli increases, the amount of information carried by the occurrence of a particular stimulus increases" (p. 206).

These studies on the objectivity and complexity of the referent are related to the present study. The present study utilizes in the communication accuracy exercise a series of patterns which constitute discrete, discernible referents. The formulation of the patterns was predicated on the assumption that the shapes and labels which comprise the patterns are simple and relatively unambiguous. Further, a complexity estimate for each of the patterns was obtained.

The task of assessing communication accuracy has been approached from the point of view of channels being used, the structure or characteristics of the message itself, and the character of the referent. The various studies which have looked at these variables should seem to indicate that these variables are related to communication accuracy.

Attributes of the communicator-addressee

The attributes of the communicator and addressee are of a like nature, and refer to attitudes, reference groups, culture, language, and modes of cognition. For the purposes of this paper the focus of this review of the related literature has been focused upon the communicator--addressee attribute of cognitive similarity.

Two studies (Harms, 1961; and Donohew, 1966) utilized a version of a cloze test to measure communication accuracy. A cloze test requires the respondent to supply the missing words or phrases. Harms recorded two minute messages of advice on the selection of good movies, television programs, and books. Three such messages were recorded, each from a speaker of differing socioeconomic backgrounds. The messages were then transcribed with each fifth word deleted to form a cloze test. The subjects were then asked to listen to the recorded messages and subsequently to read the transcribed cloze test versions. Communication accuracy was measured by determining how accurately the missing words were supplied. Harms reports that the greatest degree of communication accuracy occurred when both speaker and listener were from the same socioeconomic group.

Donohew (1966) also reports the results of a cloze test to determine communication accuracy. Two groups of subjects, the first selected by virtue of membership in a conservative political club, the second by membership in a nonpolitical club, responded to a written message about a poll assessing the effect of John Kennedy's assassination upon the popularity of Barry Goldwater. Half of the subjects in each group read material which included a paragraph which had been manipulated to show that the effect had been to decrease Goldwater's popularity. The second half of the subjects in each group read that Goldwater's popularity had not been affected. The subjects were then given a cloze test which had been devised by taking the critical paragraph and deleting 50 words at random. The supplying of the missing words was the measure of communication

accuracy. Donohew reported that neutral messages--those that do not create negative attitudes are more accurately decoded.

The studies cited above are examples of research which have looked at communication accuracy as it is related to communicator-addressee attributes. The concept of cognitive style falls within the definition of attribute similarity as provided by Mehrabian and Reed.

> A communicator attribute is a characteristic or state of a communicator which may be either of a temporary or a relatively permanent quality. Addressee attributes are conceptualized similarly (p. 366).

The remainder of this review of related research will focus upon those studies which have examined communication accuracy in relationship to the attribute variable of communicator and addressee cognitive style.

Research on Cognitive Similarity and Communication Accuracy

Newcomb's work in the areas of interpersonal attraction and communicative acts has provided much of the impetus for the study of communicator-addressee similarity and communication accuracy (Newcomb, 1953, 1956, 1958). Triandis succinctly presents the essence of Newcomb's reasoning and research.

> To the extent that A and B are cognitively similar (orient towards significant aspects of their environment in similar ways) and there is an opportunity for communication (e.g., propinquity), communication should be effective, and the relationship between A and B should be rewarding, and interaction should lead to increased liking of A for B and B for A (sociometric choice). Increased liking should result in higher rates of interaction between A and B and this, in turn, should produce greater cognitive similarity, this starting the cycle all over again (1960, p. 175).

Closely related to Newcomb's work was a doctoral study conducted in 1956. Runkle (1956) hypothesized that there would be a greater degree of communication accuracy or effectiveness between teachers and students who were cognitively similar than between teachers and students with less cognitive similarity. Runkle utilized a measure of cognitive similarity based on a technique which determines the degree of correspondence of the methods used in making judgments by two individuals. Three measures of similarity were used: (1) cognitive similarity inferred from the degree of correspondence of student and teacher ranking of attitudinal statements; (2) student agreement with teacher attitudes on the statements; and, (3) student scholastic aptitude scores. The measure of communication accuracy was the students' performance on course examinations. Runkle reports that the cognitive similarity of teacher and students was the only significant positive correlate of student performance.

In a widely cited study, Triandis (1960) carried out at Cornell University, two hypotheses related to communication accuracy were tested.

> H_1: The greater the communication similarity between two persons A and B the more effective will be the communication between them.
>
> H_2: The greater the attribute similarity between A and B the greater the communication effectiveness between them (p. 176).

Attribute or cognitive similarity was determined by showing each member of a pair of subjects twelve triads of pictures of facial expressions of emotion. Each member of the pair was asked to

respond to three questions: "Which of these three pictures is more different from the other two?"; "Which of its characteristics makes it different?"; and, "What is the opposite of the characteristic that makes it different?"

The lists obtained from A and B were subjected to a comparative content analysis and a measure of attribute similarity thus derived. The measure of communication accuracy was a communication game in which the pairs of subjects were seated at opposite sides of a table separated by a cardboard partition. Each of the subjects was given a pair of pictures from one of the triads of pictures used earlier. Each of the sets of two pictures contained one picture common to both sets. The goal of the game was to determine which was the picture common to both sets. The subjects were allowed to send as many messages as they wished during a 12 minute time limit. Each message consisted of a pair of polar opposites, such as intelligent-unintelligent, depressed-excited, and a number, between 1 and 7, signifying the degree to which the first adjective, in the message, described the picture (p. 177). Each pair of subjects played six twelve-minute games under three different sets of conditions: (1) a free-list condition, in which the subjects could use any adjectives they chose; (2) a different-list condition, in which the subjects were required to use adjectives from different lists, and which were as different as possible; and, (3) a same-list condition, in which the subjects were required to use adjectives provided by the experimenter. Both of the subjects had the same list (p. 178).

Triandis reported the following results:

> The first hypothesis was that communication similarity between A and B will lead to communication effectiveness. The communication similarity score for all three conditions was plotted against the communication effectiveness score, and the relationship was found to be linear. The correlation between the two variables was $r=.83$; $p < .001$.
>
> The second hypothesis was the higher the attribute similarity, A, the greater the communication effectiveness, E. The two variables were plotted, and the relationship was found to be curvilinear (monotonically negatively accelerated) with an asymptote a high level of communication effectiveness. $\eta = .83$ ($p < .001$) (p. 179).

The findings thus reveal that the greater the attribute similarity the greater the communication accuracy, and the greater the communication similarity the greater the communication effectiveness. Of particular significance to the present study is the finding that the two kinds of similarity, attribute similarity and communication (language) similarity are not correlated.

> The findings that the two kinds of similarity are not correlated suggests that they are very different in nature. Attribute similarity undoubtedly involves perceptual categories that are not involved in communication similarity (p. 181).

Cognitive similarity as reflected by measures of centering or decentering, and communication accuracy was examined in a study by Feffer and Suchlotiff (1966). This study is of interest because it used a communication activity to measure accuracy of the decoding process. A group of thirty-six male and female undergraduate students were given a group version of a role task taking (RTT) instrument to determine each individual's centering ability. The subjects were then paired into dyads on the basis of their similar centering ability. Each subject was also given a

vocabulary test, a word-association test, and a word fluency test. The task of the study was for the dyads to play a version of a password game. The sender was to give one word clues, and the recipient was to guess at the test word with one word responses. Accuracy was determined by the length of time and number of cues needed to communicate the test list of 36 words. Feffer and Suchlotiff reported that the dyad differences in the password game ". . . appear to be systematically related to RTT differences" (p. 420). When the authors analyzed the data in regard to other variables they concluded that:

> . . . neither verbal fluency scores nor WAIS Vocabulary scores were significantly related to either RTT or password measures. It was thus inferred that these variables did not contribute essentially to the association between password and RTT performance (p. 420).

It is worth noting that Feffer and Suchlotiff's finding that neither verbal fluency nor vocabulary scores was related to communication accuracy would tend to support the finding of Lantz and Stefflre that the element of language does not seem to be related to communication accuracy.

Studies which have looked at the effect of teacher-student cognitive similarity suggest that students who have a cognitive style similar to that of their teacher tend to achieve higher grades than do students whose cognitive style is dissimilar to that of their teacher. It has also been reported that teachers get more positive evaluations from students who are cognitively similar than they do from students who are cognitively dissimilar. In studies which have utilized a game strategy as a measure of accuracy

those participants whose cognitive styles were similar were more accurate than those with dissimilar styles.

The number of studies whose purpose it has been to evaluate communication accuracy in relationship to cognitive similarity is small, but out of that limited body of research the hypothesis that cognitive similarity is related to communication accuracy seems clearly to emerge.

Summary of Chapter

The review of literature has been concentrated in the areas of the Educational Science of cognitive style and communication accuracy. The review has been partitioned into four general topic areas. The first and second areas covered by this review were the Educational Sciences and cognitive style. Within these topic areas an overview of the Educational Sciences and brief definitions of additional terms used in the cognitive style instrument were given.

The third and fourth topic areas review the literature on communication accuracy as it is related to five determinants of communication accuracy: attributes of the channels; attributes of the communication; attributes of the referent; and, attributes of the communicator-addressee.

CHAPTER III

DESIGN OF THE PROBLEM

Review of the Problem

The purpose of the study was to determine if communication accuracy is related to the degree of cognitive similarity between teacher and student in selected sections of Interpersonal Communication I.

Source of Data

Population

The population consisted of teachers and students in nine selected sections of the basic course, Interpersonal Communication I, of the Department of Communication Arts and Sciences, Western Michigan University, Fall Semester, 1975.

Criteria for sample selection

Instructors of Interpersonal Communication I were invited by letter to participate in the study. From those who indicated a willingness to participate, the selection of sections was made on the basis of the following criteria:

1. No instructor will be represented by more than one section.
2. No night sections will be included in the sample.
3. No special sections such as an Honors section will be included in the sample.

4. The instructors whose sections are selected will have had at least one year of experience in teaching Interpersonal Communication I.

Description of the sample

The Cognitive Style Interest Inventory Test was administered to 210 students and nine instructors. All nine instructors (and 166 students) participated in the communication accuracy exercise, while because of absence only 166 students participated. Two sections, two instructors and 41 students were eliminated from the final sample because of irregularities in the execution of the accuracy exercise. The sample, then, for this study consisted of 125 students and seven instructors.

Students enrolled in Interpersonal Communication I come from all colleges and departments of the University. The majority of the students in the sample were between the ages of 18-21 years and were classified as sophomores or juniors. Classifications based upon age and sex are not specifically included in this description as these characteristics were not used as variables in the study.

Method of Gathering the Data

Cognitive Style Interest Inventory Test

The Cognitive Style Interest Inventory Test was administered by the researcher and by colleagues trained by her. On September 15 or 16, 1975, whichever was the first class meeting of the week, nine instructors and 210 students took the Cognitive Style Interest Inventory Test during their regular class period. The completed answers recorded on IBM cards were returned to the researcher who

arranged to have them scored, to have the individual cognitive maps prepared, and who carried out the matching procedure.

The students in each of the selected sections of Interpersonal Communication I were invited to take the Cognitive Style Interest Inventory Test and were explicitly informed that they were not required to take the instrument or to participate in the study. As a reward for participating in the study each student who took the cognitive style instrument was promised a copy of his own cognitive style profile as prepared by the testing center at Oakland Community College. The promise was kept and the students were given copies of their maps two weeks after they took the cognitive style instrument.

Instrumentation

Rationale for using test

The Cognitive Style Mapping Interest Inventory Test is one of a number of instruments developed by Dr. Joseph E. Hill and his associates at Oakland Community College which purport to measure cognitive style. The test is gaining acceptance and use as a measure of cognitive style. The interest inventory test was developed for use with college students and measures a person's preference in using the various symbols and modes expressed in cognitive style. The interest inventory test is easily administered within a fifty minute period which corresponds to a regular class period.

Validity

Establishing the validity of the Cognitive Style Mapping Interest Inventory Test is based upon the concept of construct validity. Hill

believes that the concepts of predictive, concurrent, and content validity are included in the concept of construct validity as it is generally understood that these aforementioned forms of validity are special cases of construct validity. Hill (1973) states that no single index of relationship can denote construct validity; rather,

> . . . the determination and description of construct validity is an on-going dynamic process, i.e., a 'program', that includes a periodic reporting of a limited number of instrumentality supplemented by verbal descriptions based upon professional judgment (p. 48).

The validation of an instrument implies the evaluation of that instrument by means of independent and external criteria. The validity of attitude, personality, and interest inventories is commonly determined by comparing their predictions to actual outcomes. Every study that uses an instrument to assess differences and finds significant differences is a demonstration of the validity of the instrument. Following this line of reasoning, any study which uses the Cognitive Style Interest Inventory Test to differentiate between styles and some other variable, and which finds significant differences is evidence of the validity of the inventory. As of August 1975 a number of studies which used the cognitive style inventory had been conducted at Oakland Community College, and upwards of 100 doctoral dissertations have been completed in this area.

Hill (1975) reported coefficients of validity in terms of construct validity of Theoretical Visual Inguistic, T(VL); Theoretical Visual Quantative, T(VQ); Theoretical Auditory Linguistic, T(AL); and Theoretical Auditory Quantitative, T(AQ) which have been derived from the Nelson-Denny Reading Test, sub-tests of the Differential Aptitude Tests (4th Ed.,

forms L and M), the Carlsen-Brown Listening Test, and the quantitative section of the "Weschler". The reported validity coefficients associated with the elements are shown below for community college samples.

T(VL)	Females = .80		T(AL)	Females = .75	
	Males = .72			Males = .70	
T(VQ)	Females = .72		T(AQ)	Females = .66	
	Males = .73			Males = .61	

Hill (1973) further discusses the concept of construct validity as it applies to the elements of style.

> Many of the elements of 'style' are intellectual constructs rather than directly observable behaviors. These elements, in their respective theoretical frameworks, are considered to be related in various ways, and to various degrees, with other characteristics of the individual under consideration, and to have certain effects upon the individual's behavior; while at the same time themselves being amenable to modification by certain types of treatments. Consequently, if an instrumentality is to provide valid measures of a 'style' element, i.e., of a constructed trait, it must necessarily provide information that reflects the posited 'relationships', the 'effects' and modifications, and the greater the number of these agreements, the more valid the instrumentality yielding this information is considered to be (p. 7).

Reliability

The concept of reliability refers to how consistently a test is able to measure the same thing repeatedly. Cognitive style is a dynamic rather than a static phenomenon. Because of the concept of cognitive style is predicated upon the assumption that an individual's cognitive style can be modified or augmented, the problem of determining the reliability of the Cognitive Style Interest Inventory Test is treated by employing the concept of domain sampling and the method of intercorrelations among the elements.

The reliability of cognitive mapping has been formulated in terms of domain sampling. Each of the elements which is found in a cognitive style map are represented in the Cognitive Style Mapping Interest Inventory Test by a series of questions. Each of the questions which relates to the various elements in an individual's cognitive style map attempts to measure the individual respondent's responses to a representative domain sampling of various situations, where a particular element being measured is apt to be used. Most college students in the United States would find the majority of the general situations presented in the inventory familiar to them.[1] It is important to keep in mind that as an individual matures, learns, and changes, the way in which he would perceive a situation would change; and thus, his responses to a particular situation would change resulting in a modification of his cognitive style.

The concept of domain sampling permits the determination of the value of a reliability coefficient on the basis of one set of scores. While the present study was not concerned with changes in cognitive style, the reliability of the inventory over a period of time could be found by a second administration of the instrument. The reliability coefficients for both the first and second administration of the instrument could then be compared.

The reported (Hill, 1975) reliability coefficients derived by means of the Kuder Richardson formula, based upon the concept of domain sampling are as shown below for the elements of Theoretical Visual Linguistic, T(VL); Theoretical Visual Quantitative, T(VQ); Theoretical

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[1]See Appendix A.

Auditory Linguistic, T(AL); and Theoretical Auditory Quantitative, T(AQ), for community college samples.

T(VL)	Females = .93		T(AL)	Females = .89
	Males = .92			Males = .87
T(VQ)	Females = .92		T(AQ)	Females = .85
	Males = .93			Males = .83

Communication accuracy exercise

The communication accuracy exercise was carried out on September 22 or 23, whichever was the first class meeting of the week. The responses to the communication accuracy exercise were returned to the researcher and were scored by her.

As with the cognitive style instrument, the students were assured that their participation in the exercise was voluntary and did not affect their course standing in any way. At the completion of the exercise the students were told what the researcher was going to be looking for, and a promise was made to share the results with the classes when such results were available. This promise was also kept.

During the administration of the communication accuracy exercise a monitor was present in each classroom. The monitor brought all of the necessary materials to the classroom, introduced the exercise, and answered any questions prior to the actual administration of the exercise. As soon as each class of students had all of the necessary materials and was ready to proceed, the instructor was given a folder containing the referent diagrams for the exercise. No instructor had seen the diagrams prior to the time he/she was given the folder immediately prior to the actual administration of the exercise, although each instructor had had an interview with the researcher prior to the

date of the actual administration of the exercise to explain the purpose of the exercise, to explain the procedures for the administration of the exercise, and to answer any questions which the instructor might have about the exercise or its administration.

Each of the instructors who participated in the study had been given the following set of directions in both written and oral form prior to the date of the actual administration of the exercise. The directions were also reproduced and distributed to the instructors for their review while the monitor was distributing the materials. The directions were:

The purpose of this exercise is to determine communication accuracy. Your task is to describe four diagrams and their labeling to your students. The task of the students is to reproduce, as accurately as possible, the diagrams and labeling which you describe.

1. Remove the individual exercise cards from the folder one at a time, as you use them. (Remove the card for exercise I, give the directions for drawing the diagram and when finished with exercise I place the card face down on the table, remove the card for set II from the folder and proceed as above. Complete all four diagrams in the same manner.)
2. Use no gestures to describe the figures.
3. Do not answer or acknowledge any questions from students.
4. Discourage any clearly recognizable nonverbal feedback, e.g., loud sighing, laughing, gross bodily activity.
5. Make no conscious effort to alter your own characteristic, preferred cognitive mode in your description of the diagram.
6. Make every effort to maintain an atmosphere in the classroom which is compatible with the seriousness of the research effort. (Let them know by your attitude and demeanor that you are serious about this activity and that you expect them to be serious also.)
7. Complete the directions for the drawing and labeling of all four sets of diagrams.
8. Work at your own speed.
9. At no time permit the students to see the diagram.

The monitor remained in the classroom while the communication accuracy exercise was being carried out. The monitor's task was to observe the administration of the exercise to determine if the procedures established for the administration of the exercise were observed, and thus prevent the inclusion in the study of any set of scores which might have varied as a result of deviation from the prescribed administration procedure. As noted earlier two sections were ultimately eliminated from the sample as a result of the monitors' reports of irregularities in the administration of the exercise. The monitoring was provided by the researcher and by colleagues trained by her.

Rationale for using exercise

The use of communication games or exercises to measure the accuracy of encoding and decoding in the communication process is a strategy which has been used in prior research on communication accuracy (Leavitt and Mueller, 1951; Triandis, 1960; Zajonc, 1960). In addition to the use of such game or exercise activities in research paradigms, such activities are commonly employed in communication classes to measure accuracy of the encoding and decoding process (Giffin and Patton, 1971; Krupar, 1973; Stewart, 1973).

Further support for using a game or exercise to measure communication accuracy is provided by Mehrabian and Reed (1968);

> One solution to the problem of finding a criterion of communication, especially for complex communications, is provided by Carroll (Osgood and Sebeok, 1965, p. 200). In Carroll's paradigm, the two communicators are seated opposite one another at a table but are separated by a partition. Each communicator has an array of referent objects (e.g., blocks of various colors and shapes, or pictures) in front of him, about which he is to communicate to the other. Perhaps the simplest type of task is one

> in which the speaker selects one of these objects and tries to communicate to the listener which one it is he has selected. Communication accuracy is achieved if the listener correctly identifies the object which the speaker has chosen. . . . the paradigm also provides an experimental analogue to the communication situation 'in which the speaker's referent is identifiable independently of the speaker's behavior' (Rosenberg and Cohen, 1966, p. 209), and in which a criterion of communication accuracy is easily established. The paradigm is pregnant with interesting manipulations, and has been employed in varied research settings (p. 366). [Emphases added.]

Criteria for the communication exercise

1. The exercise should be similar to common classroom procedure (e.g., the giving of instructions, assignments, data, information).

2. The exercise should not require the understanding or manipulation of any special, unfamiliar, or unusual equipment or materials.

3. The exercise should be of such a nature that it can be carried out within the physical structure of a normal classroom.

4. The exercise must involve both the encoding and the decoding processes.

5. The exercise must involve the language process.

6. The exercise must permit the instructor the freedom to employ his preferred cognitive style in the encoding process.

7. The exercise must employ discrete, discernable referents.

8. The exercise must produce a concrete, observable measure of the decoding process.

9. The exercise must have some precedent as a measure of accuracy.

Description of the communication exercise

The purpose of the communication exercise was to determine how accurately the students decoded the message which was encoded by their

instructor. The measure of accuracy was assessed by determining how closely the figures and labeling which the students produced matched the figures and labeling which their instructor described.

The task of the communication exercise was for the students to produce and to label a series of shapes which their instructors described. The exercise was partitioned into four parts.

Part one. In part one of the exercise the instructors gave directions for drawing and labeling a set of simple figures. The task of the students was to produce and to label the drawing accurately. The first part of the exercise was designed to provide a training and cognitive tuning (Zajonc, 1960) session. Part one of the exercise was not scored, and was not considered as part of the communication accuracy exercise for the purposes of this study.

Part two. In part two of the exercise the students attempted to produce accurately a series of shapes and their labels as described by their instructors. The series of shapes and labels differed from those used in part one of the exercise.

Part three. In part three of the exercise the students attempted to produce accurately a series of shapes and labels as described by their instructors. The series of shapes was more complex than the shapes used in parts one and two, and the labeling of the shapes differed from the form used in parts one and two.

Part four. In part four of the exercise the student attempted to produce accurately a series of shapes and labels as described by their instructors. The series of shapes was more complex than the shapes used in parts one, two, and three, and the labeling of the shapes

also differed.[1]

Complexity

In an effort to obtain some measure of the perceived complexity of the shapes to be employed in the communication accuracy exercise, 66 students enrolled in communication courses during the 1975 Summer Session were asked to rate the three figures in terms of their relative complexity. The three figures rated are those to be used in parts II, III, and IV of the communication accuracy exercise.

Each student was given copies of the three figures and a response sheet. The response sheet was divided into two parts. Part one asked the student to do the following:

> Please look carefully at Figure II. Now look at Figure III. Is Figure III more difficult, that is, more complex than Figure II? Please circle the response that tells how much more complex you think Figure III is.

The students were provided with a rating scale with 5 intervals: (1) no difference in complexity; (2) slightly more complex; (3) moderately more complex; (4) very much more complex; and (5) greatly more complex. In addition, there was a sixth response option, a box to be checked if the student felt that he/she could not tell the difference.

Part two of the response sheet asked the student to respond in the same manner to the perceived differences in complexity of figures III and IV.

Results--Figure III was seen as more complex than Figure II, with a mean rating of 2.43 on the scale of 1 to 5. No student indicated

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[1]See Appendix B.

that he/she could not tell any difference. Figure IV was seen as more complex than Figure III, with a mean rating of 4.17 on the scale of 1 to 5. No student indicated that he/she could not tell any difference.

Testable Hypotheses

Hypothesis 1

Hypothesis 1: The group of students who have a high degree of cognitive match with their teacher will have a mean score on the communication accuracy exercise at all levels of complexity which exceeds that of the group of students who have a moderate degree of cognitive match with their teacher.

Symbolically: H_o: $M_1 > M_2$

Legend: M_1 = high match group mean; M_2 = moderate match group mean

Hypothesis 2

The group of students who have a high degree of cognitive match with their teacher will have a mean score on the communication accuracy exercise at all levels of complexity which exceeds that of the group of students who have a low degree of cognitive match with their teacher.

Symbolically: H_o: $M_1 > M_3$

Legend: M_1 = high match group mean; M_3 = low match group mean

Hypothesis 3

The group of students who have a moderate degree of cognitive match with their teacher will have a mean score on the communication accuracy exercise at all levels of complexity which exceeds that of

the group of students who have a low degree of cognitive match with their teacher.

Symbolically: H_o: $M_2 > M_3$

Legend: M_2 = moderate match group mean; M_3 = low match group mean

Treatment of the Data

Cognitive mapping

After the responses to the Cognitive Style Mapping Interest Inventory Test were obtained from students and teachers in the selected sections of Interpersonal Communication I, the responses were scored and a computerized version of each person's cognitive map was prepared at Oakland Community College. The maps indicate the predominant and supportive elements of an individual's cognitive style. Major elements are those elements in which the person scored above the 50th percentile. Minor elements are those elements in which the person scored in the percentile range between 25-49. Negligible elements are those elements in which the person scored in the percentile range between 1-24. Minor and negligible elements are regarded as supportive elements, while major elements are considered predominant elements.

The concept of set is basic to the process of cognitive mapping, and is symbolized by braces []. The concept of set has been defined as a carefully defined collection of discrete elements, wherein an element has been described as a fundamental constituency of a set. Cognitive mapping uses the sets of symbols and their meanings, cultural determinants of the meaning of symbols, and modalities of inference.

The Educational Science of cognitive style is defined as a

cartesian product, G, composed of three sets, S, E, and H., where S denotes the set of elements defining symbolic orientations, E indicates the set of cultural determinants of the meaning of symbols, and H designates the set of modalities of inference (Hill, 1971, p. 2).

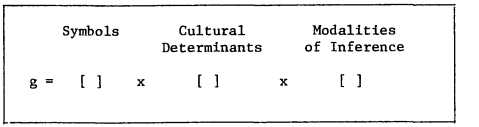

Figure 1. Sample of cognitive style map.

Hill (1972) has made the following explanation of mapping:

> Arranging the elements of a Set A into two subsets that are considered to form a second Set B is the process mathematicians term mapping. Mathematical mapping employs only the theoretical symbols of mathematics of abstract logic, in the form of functions or equations, to effect the mapping process. Empirical mapping involves human and other forms of information to effect the mapping (p. 47).

More detailed explanations of the mapping process can be located in other sources (Hill & Kerber, 1976; Hill, 1973).

Determining degree of cognitive style match

Once the individual cognitive style maps for each student and instructor who participated in the study were obtained from Oakland Community College, the degree of match between the map of each student and his/her instructor was determined using a matching routine suggested by Hill (1973). In this study the instructor's style was selected as the "referent" style and the students' styles were matched with that of their instructor.

The matching procedure. The degree of match, or percent of match between two cognitive styles is determined by using a matching routine based upon referent style. In other words, the referent style is the base style to which a second style is compared. The determination of which style will be regarded as the referent is generally made on the basis of which of the styles has the most value to the researcher; thus, in the matching of teacher and student styles, the teacher's style is normally selected as the referent.

Each element in the referent style is assigned a value of "3." Elements in both cognitive styles are then compared. If the element in the second cognitive style falls into the same percentile range as the referent style, then the element is assigned a value of "3." If the elements in both styles have the same orientations, i.e., both "majors" but do not fall into the same percentile ranges, a score of "2" is assigned. If both element orientations differ, i.e., "major" or "minor" but not a "null," then the number assigned to the element will be a "1." Finally, if the element is absent in either one of the cognitive maps, i.e., "null" or "negligible," an "0" is scored for the element.

Within the set of symbols and their meanings all elements are scored as binomial combinations of each theoretical symbol with each qualitative symbol, i.e., T(VL) - Q(CEM), T(VL) - Q(CES), etc. The binomial combinations, i.e., the values assigned to the theoretical and the qualitative, are added together to yield a total value for each binomial combination. In the referent style each of the elements of the binomial are assigned a "3" and the total value for each combination which appears in the referent style is then "6."

The sets of cultural determinants and modalities of inference are scored in essentially the same manner, i.e., adding the values assigned to each element with a major or minor orientation. Two final points should be clarified to prevent possible confusion about the matching procedure. The element of deductive reasoning, (K), is never used in the matching procedure; and the appraisal element, (L), although issued a score does not appear on a cognitive style map unless it falls within the percentile range of major element. However, since the appraisal element (L) is composed of a degree of three other elements it may be assigned a value as high as "9."[1]

Once the total number of points has been determined for each of the three "sets" for both the referent style and the style being matched to it, the percent or degree of match between the two individual styles can be determined. The numeric sum for each "set" in the style being matched to the referent style is compared to the numeric sum for each "set" in the referent style. The comparison is expressed as a fraction with the numeric sum of the particular "set" of the referent style functioning as the denominator of the fraction and the numeric sum of the particular "set" of the style being matched functioning as the numerator of the fraction. These fractions are then transposed into percentages, the three percentages are added together, and then divided by the total number of sets which is three. This procedure then provides a degree of match which is expressed, for example, as .68 or 68%.

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[1]See Appendix C.

Determining categories of cognitive similarity

Once a percentage of cognitive match between each student and instructor had been determined it was necessary to group the students based upon the degree of match. A frequency distribution of the 125 match scores was prepared. Those scores which fell in the upper third of the distribution were categorized as having a high degree of match; those scores which fell within the middle third of the distribution were categorized as having a moderate degree of match; those scores which fell within the lower third of the distribution were categorized as having a low degree of match.

The 125 scores ranged between the values of .320 and .973. The 42 scores which fell into the low-match category ranged in value from .320 to .636 and had a mean value of .573. The moderate-match category was represented by 43 scores which ranged in value from .637 to .731 and had a mean value of .680. The high-match category contained 40 scores which ranged in value from .732 to .973 and had a mean value of .831.

TABLE I

CATEGORIES OF COGNITIVE MATCH SCORES

		Lower Value	Upper Value	Mean
Low-Match	42	.320	.636	.573
Moderate-Match	43	.637	.731	.680
High-Match	40	.732	.973	.831

Determining the communication accuracy exercise score

After all of the students in the sample had participated in the communication accuracy exercise the students' drawing of Part II, Part III and Part IV of the exercise were scored to determine the accuracy with which the drawings had been reproduced. Part I of the exercise was not scored because, as was noted earlier, Part I of the exercise was designed as a training and cognitive tuning device and was not considered as a part of the accuracy exercise.

In the scoring of the communication accuracy exercise the referent drawing was at all times the criterion for accuracy; however, the drawings were scored with the awareness that the drawings were made without the use of aids such as ruler or compass. Thus if a student clearly intended to draw a figure such as a rectangle the figure was scored as accurate even if all lines were not parallel. The scoring was conducted using a minus points procedure. The maximum possible points for each of the diagrams was established and the score for each part of the exercise was then determined by subtracting the minus points from the total possible.[1]

In an effort to check the reliability of the scoring procedure, the drawings of 25 students, approximately 20% of the sample, were drawn at random and were independently rescored by a colleague of the researcher. The mean difference between the pairs of scores for the 25 subjects was 1.283.

Normalized standard scores

Frequency distributions for each of the three parts of the

[1]See Appendix D.

communication accuracy exercise showed that the scores on each part of the exercise were skewed toward the upper end of the distributions. Also, the three parts of the communication accuracy exercise were not in themselves directly comparable in terms of raw scores due to the fact that there were different possible maximum scores for each part of the exercise. Therefore, in order to compare the scores on the three parts of the communication accuracy exercise, the scores were transformed into normalized standard scores with the mean set at 50 and the standard deviation set at 10. The procedure used to normalize the scores was that suggested by Cronbach (1960, pp. 84-86). The scores for each part of the communication accuracy exercise were converted into percentile scores. The percentile scores were then compared to a table from which the corresponding normalized T scores were obtained. Using the derived scores permits a comparison of performance on the three parts of the communication accuracy exercise.

Analysis of Variance

The final step in the treatment of the data was to test the data for significant differences. A 3 x 3 factorial analysis of variance was carried out using the factors of degree of cognitive match and level of exercise complexity. The means of the three categories of cognitive match were subsequently compared by use of *t*-tests.

Summary

This chapter was concerned with the design of the study. The source of the data and an explanation of the procedures for gathering the data were explained. Rationales were provided for the instruments

used. The hypotheses were stated and the treatment of the obtained data was explained.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Overview

There were two methods employed in the analysis of data. A 3 x 3 factorial analysis of variance was performed using as the factors the three categories of cognitive match and the three levels of exercise complexity; and *t*-ratios to compare the mean accuracy exercise scores for the three groups of students, i.e., high-match, moderate-match, low-match were obtained.

Analysis of Data

A factorial analysis of variance was carried out to assess the significance of the main effects, degree of cognitive similarity and level of exercise complexity, and to assess the interaction between similarity and complexity upon communication accuracy scores. A summary of that analysis is found in Table II. An examination of that table fails to show significant differences among the scores as the F-ratio had a value of 0.12 (df 2, P .8901) which is not significant. For the factor of degree of cognitive match a difference was found as the F-ratio was 3.52 (df 2, P .0307) which is significant at the .05 level. The interaction was significant with an F-ratio of 3.13 (df 4, P .0150).

TABLE II

A SUMMARY OF ANALYSES OF VARIANCE
ALL CATEGORIES OF MATCH AND ALL COMPLEXITY LEVELS

Source	df	s.s.	m.s.	F	P
Levels of Complexity	2	32.76	16.38	0.12	.8901
Degree of Match	2	990.19	494.09	3.52	.0307
Interaction	4	1760.58	44.14	3.13	.0150
Within	366	51501.09	140.71		
Total	347				

Hypothesis 1

Hypothesis 1: The group of students who have a high degree of cognitive match with their teacher will have a mean score on the communication accuracy exercise at all levels of complexity which exceeds that of the group of students who have a moderate degree of cognitive match with their teacher.

The data in Table III fail to show that the hypothesis is supported.

The mean value for the high-match group for all combined levels of exercise complexity was 49.87 with a standard deviation of 10.73; while the mean value for the moderate match group for all combined levels of exercise complexity was 53.08 with a standard deviation of 12.66, as seen in Table IV.

Not only was hypothesis 1 not supported by the data, but an

TABLE III

MEAN AND STANDARD DEVIATION FOR HIGH AND MODERATE CATEGORIES OF MATCH AND ALL LEVELS OF COMPLEXITY

Categories of March		Levels of Complexity C_1	C_2	C_3
High-Match (N=40)	Mean	48.63	53.49	47.49
	Standard Deviation	9.74	11.43	10.24
Moderate-Match (N=43)	Mean	53.45	53.52	52.27
	Standard Deviation	13.19	12.15	12.88

TABLE IV

MEAN AND STANDARD DEVIATION OF EXERCISE SCORES FOR HIGH AND MODERATE CATEGORIES OF MATCH FOR ALL COMBINED LEVELS OF COMPLEXITY

Variable	N	Mean	Standard Deviation
High-Match	40	49.87	10.73
Moderate-Match	43	53.08	12.66

examination of Table V which reports the t-ratio for the high and moderate match groups for the combined exercise scores reveals that there was a significant difference between the two means in the direction of the moderate-match group which was opposite to the hypothesized

direction. The t-ratio was 2.145 (df=81, P .033).

TABLE V

AN ANALYSIS OF MEAN DIFFERENCES FOR HIGH AND MODERATE CATEGORIES OF MATCH FOR ALL COMBINED LEVELS OF COMPLEXITY

Variable	Mean	t	df	P
High-Match	49.87			
		-02.149	81	.033
Moderate-Match	53.08			

Hypothesis 2

Hypothesis 2: The group of students who have a high degree of cognitive match with their teacher will have a mean score on the communication accuracy exercise at all levels of complexity which exceeds that of the group of students who have a low degree of cognitive match with their teacher.

The data in Table VI fail to show that the hypothesis is supported.

The mean value for the high-match group for all combined levels of exercise complexity was 49.87 with a standard deviation of 10.73; while the mean value for the low-match group for all combined levels of exercise complexity was 53.38 with a standard deviation of 12.35, as seen in Table VII.

Not only was hypothesis 2 not supported by the data, but an examination of Table VIII which reports the t-ratio for the high and low-match groups for the combined exercise scores reveals that there was a significant difference between the two means in the direction of the

TABLE VI

HIGH AND STANDARD DEVIATION FOR HIGH AND LOW CATEGORIES OF MATCH AND ALL LEVELS OF COMPLEXITY

Categories of Match		Levels of Complexity C_1	C_2	C_3
High-Match (N=40)	Mean	48.63	53.49	47.49
	Standard Deviation	9.74	11.43	10.24
Low-Match (N=42)	Mean	55.43	49.72	55.58
	Standard Deviation	13.00	11.71	11.68

TABLE VII

MEAN AND STANDARD DEVIATION OF EXERCISE SCORES FOR HIGH AND LOW CATEGORIES OF MATCH FOR ALL COMBINED LEVELS OF COMPLEXITY

Variable	N	Mean	Standard Deviation
High-Match	40	49.87	10.73
Low-Match	42	53.38	12.36

low-match group which was opposite to the hypothesized direction. The t-ratio was 2.508 (df=80, P .013).

TABLE VIII

AN ANALYSIS OF MEAN DIFFERENCES FOR HIGH AND LOW CATEGORIES OF MATCH FOR ALL COMBINED LEVELS OF COMPLEXITY

Variable	Mean	t	df	P
High-Match	49.87			
		-2.508	80	.013
Low-Match	53.58			

Hypothesis 3

Hypothesis 3: The group of students who have a moderate degree of cognitive match with their teacher will have a mean score on the communication accuracy exercise at all levels of complexity which exceeds that group of students who have a low degree of cognitive match with their teacher.

The data in Table IX fail to show that the hypothesis is supported.

The mean value for the moderate-match group for all combined levels of exercise complexity was 53.08 with a standard deviation of 12.66; while the mean value for the low-match group for all combined levels of exercise complexity was 53.08 with a standard deviation of 12.36, as seen in Table X.

An examination of Table XI which reports the t-ratio for the moderate and low-match groups for the combined exercise scores reveals that the hypothesis was not supported by the data as the t-ratio is .3196 (df=83, P 750) which is not significant. It is evident then, that the means of the two groups are not different.

TABLE IX

MEAN AND STANDARD DEVIATION FOR MODERATE AND LOW CATEGORIES OF MATCH AND ALL LEVELS OF COMPLEXITY

Categories of Match		Levels of Complexity C_1	C_2	C_3
Moderate-Match (N=43)	Mean	53.45	53.52	52.27
	Standard Deviation	13.19	12.15	12.88
Low-Match (N=42)	Mean	55.43	49.72	55.58
	Standard Deviation	13.00	11.71	11.68

TABLE X

MEAN AND STANDARD DEVIATION OF EXERCISE SCORES FOR MODERATE AND LOW CATEGORIES OF MATCH FOR ALL COMBINED LEVELS OF COMPLEXITY

Variable	N	Mean	Standard Deviation
Moderate-Match	43	53.08	12.66
Low-Match	42	53.38	12.36

The bases upon which the judgment was made that none of the hypotheses tested in this study were supported by the data and its analysis can be seen in summary table XII.

TABLE XI

AN ANALYSIS OF MEAN DIFFERENCES FOR MODERATE AND LOW CATEGORIES OF MATCH FOR ALL COMBINED LEVELS OF COMPLEXITY

Variable	Mean	t	df	P
Moderate-Match	53.08			
		-.3196	83	.750
Low-Match	53.58			

TABLE XII

SUMMARY ANALYSIS OF MEAN DIFFERENCES FOR ALL CATEGORIES OF MATCH AND ALL COMBINED LEVELS OF COMPLEXITY

Variable	Mean	t	df	P	Significance
High-Match	49.87				
		-2.149	81	.033	.05
Moderate-Match	53.08				
		-3196	83	.75	ns
Low-Match	53.58				
		-2.508	80	.013	.05
High-Match	49.87				

Interaction effect

It had been conjectured that the interaction of the two factors, degree of cognitive similarity and level of exercise complexity, might result in some differential effect upon accuracy scores. The supposition

was that the more complex the message, i.e., exercise complexity, the more likely would the effect of the degree of cognitive similarity be evidenced upon accuracy. It was anticipated that at exercise complexity level three, the high-match group would score significantly higher than the low or moderately-matched groups because the relationship of degree of cognitive similarity to communication accuracy would vary with the level of task complexity. In other words, the way differential match impacts on communication accuracy will change depending on the levels of complexity of the task about which communication is taking place.

Table II shows that the interaction of the two factors was significant; however, Figure 2 which shows the nature of the interaction effect of the degrees of cognitive similarity and levels of exercise complexity was to reduce accuracy as represented by scores on the communication accuracy exercise.

Summary

The data analysis chapter has been divided into four parts. Each of the three hypotheses which were postulated in Chapter III was examined in terms of the obtained data and its analysis. The data were displayed in the form of tables, but they failed to support the hypotheses. The fourth section of this chapter dealt with a conjectural relationship based upon the interaction of the two factors, degree of cognitive similarity and levels of exercise complexity. The results of a factoral analysis of variance were presented, and it was determined that a cognitive match effect as well as the interaction effect observed were generally in a direction which was opposite to that which had been postulated.

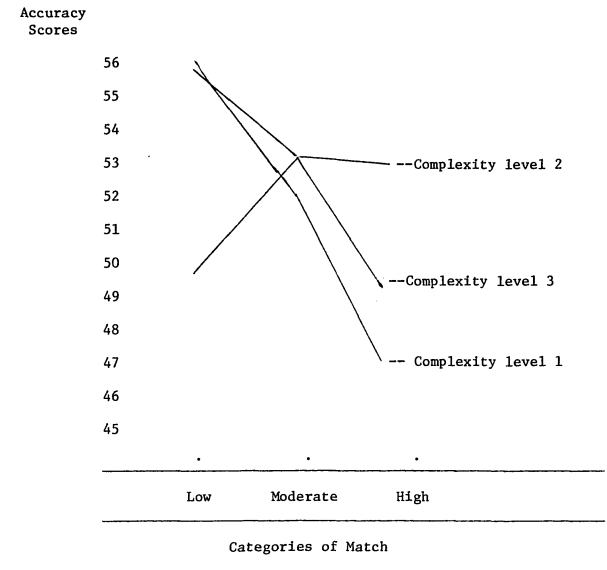


Figure 2. Mean accuracy scores for each level of complexity and each degree of match.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

Overview

This chapter has been partitioned into four sections. The first section consists of a brief summary of the study; in the second section conclusions are drawn and discussions are made about each of the three questions raised in Chapter I and about a conjectured relationship; the third section is a general discussion of the basic research question raised by the study and of the findings reported in Chapter IV; and, in the fourth section the various implications for future research are considered.

Summary

The purpose of this study was to determine if the degree of match between the cognitive styles of teachers of selected sections of Interpersonal Communication I and the cognitive styles of students enrolled in those sections of Interpersonal Communication I is related to accuracy of communication. The general area of communication effectiveness, which though related to communication accuracy, was considered as outside the scope of the study as was the general area of cognitive development.

The sample for this study was drawn from the population of teachers

and students in selected sections of Interpersonal Communication I, Western Michigan University, Fall 1975. A total of 125 students and seven instructors were included in the sample.

The first step was to determine the cognitive style of the teachers and students as measured by the Cognitive Style Mapping Interest Inventory Test developed by the Educational Sciences. The second step was to determine the degree of match between the cognitive maps of the teachers and students in the sample. The third step was to determine the degree of communication accuracy between teachers and students in the sample by means of a communication accuracy exercise. The fourth step was to analyze the data so as to permit the evaluation of the relationship between cognitive style match and communication accuracy.

Conclusions and Discussion

The conclusions of the study are drawn in response to the general question upon which the study was based: is similarity of cognitive style, as measured by the Cognitive Style Mapping Interest Inventory Test related to accuracy of communication? The conclusions are stated as responses to the specific questions posed in Chapter I, and are based upon the analysis of data reported in Chapter IV.

Question 1: Is there any difference between those students who have a high degree of cognitive match with their teacher and those students who have a moderate degree of cognitive match with their teacher in their scores on the communication accuracy exercise at three different levels of complexity?

Conclusion

The answer to question 1 is affirmative: there is a difference between those students who have a high degree of cognitive match with their teacher and those students who have a moderate degree of cognitive match with their teacher in their scores on the communication accuracy exercise. The difference which was found however, was not in the direction of the high-match group, but rather, in the direction of the moderate-match group.

Discussion

The analyses of Tables III, IV, and V in which the means for both the high and the moderate-match groups for each level of exercise complexity and for all combined levels of complexity were displayed, and in which the computed t-ratio was reported, does not support hypothesis 1 which hypothesized that the high-match group would have mean scores which were significantly higher than those of the moderate-match group. Not only was hypothesis 1 not supported by the data, but the t-ratio as reported in Table V shows that the direction of the difference was in the direction of the moderate-match group. The difference between the two groups was significant at the .05 level.

Question 2: Is there any difference between those students who have a high degree of cognitive match with their teacher and those students who have a low degree of cognitive match with their teacher in their scores on the communication accuracy exercise at three different levels of complexity?

Conclusion

The answer to question 2 is affirmative: there is a difference between those students who have a high degree of cognitive match with their teacher and those students who have a low degree of cognitive match with their teacher in their scores on the communication accuracy exercise. The difference which was found, however, was not in the direction of the high-match group, but rather, in the direction of the low-match group.

Discussion

The analyses of Tables VI, VII, and VIII in which the mean for both the high and low-match groups for each level of exercise complexity and for all combined levels of complexity were displayed, and in which the computed t-ratio was reported, does not support hypothesis 2 which hypothesized that the high-match group would have mean scores which were significantly higher than those of the low-match group. Not only was hypothesis 2 not supported by the data, but the t-ratio as reported in Table VIII shows that the direction of the difference was in the direction of the low-match group. The difference between the two groups was significant at the .05 level.

Question 3: Is there any difference between those students who have a moderate degree of cognitive match with their teacher and those students who have a low degree of cognitive match with their teacher in their scores on the communication accuracy exercise at three different levels of complexity?

Conclusion

The answer to question 3 is negative: a difference was not found between those students who have a moderate degree of cognitive match with their teacher and those students who have a low degree of cognitive match with their teacher in their scores on the communication accuracy exercise.

Discussion

The analyses of Tables IX, X, and XI in which the means for both the moderate and low-match groups for each level of exercise complexity and for all combined levels of complexity were displayed, and in which the computed t-ratio was reported, does not support hypothesis 3 which hypothesized that the moderate-match group would have mean scores which were significantly higher than those of the low-match group. The t-ratio reported in Table XI shows that the means of the two groups are not significantly different.

Interaction effect. While not specifically spelled out in the form of a hypothesis, it was conjectured that the interaction of the two factors, degree of cognitive similarity and level of exercise complexity might result in an effect upon the exercise scores. The supposition was that the more complex the message, i.e., exercise complexity, the more likely would the effect of the degree of cognitive similarity be evidenced upon accuracy.

Conclusion

There appears to be an interaction between the factors of degree of cognitive similarity and exercise complexity. The interaction

effect, however, was not that which had been conjectured: the high-match group of students performed less well on the most complex portion of the accuracy exercise than did either the moderate-match group or the low-match group.

Discussion

It was anticipated that at exercise complexity level 3 the high-match group would score significantly higher than the low-match or the moderate-match group due to the supposed interaction of the degree of cognitive match and level of exercise complexity. An examination of Table II which reports the summary of the factorial analysis of variance fails to reveal that there were differences between the levels of complexity, but that for the factor of degree of cognitive match there were differences. It is difficult to explain the fact that no difference was found between the levels of complexity as the exercise had been rated by three groups of students including a group of graduate students as having a progressive pattern of complexity. It was anticipated that there would be differences between the three categories of cognitive match, but not in the direction in which they were found.

As previously reported in Table II the analysis of the relationship of degree of cognitive match to accuracy at different levels of exercise complexity revealed that there was a significant interaction effect. The F-ratio of 3.13 (df=4, P .0150) was significant at the .05 level and approached the .01 level. An examination of Figure 2 which plots the mean accuracy scores for each level of exercise complexity and each category of cognitive match indicates that the nature of the interaction which was observed was not that which had been anticipated.

General Conclusion and Discussion

The general question asked by this study was: is similarity of cognitive style, as measured by the Cognitive Style Mapping Interest Inventory Test related to accuracy of communication? Accuracy of communication is not enhanced by the extent to which the communicator and addressee share a common cognitive style. There appears to be no positive relationship between similarity of cognitive style as measured by the Cognitive Style Mapping Interest Inventory Test and communication accuracy as measured by the accuracy exercise employed in this study.

Discussion

The theoretical hypothesis upon which this study was predicated was that similarity of cognitive style is related to accuracy of communication. The implied nature of that relationship was that the greater the similarity of cognitive styles the greater would be the accuracy of communication. Analysis of the data obtained from the measures of cognitive similarity and of communication accuracy does not support the assumption that the more similar the cognitive styles the more accurate the communication. In fact, the data show that as the degree of cognitive similarity increased, low--moderate--high, the mean scores for all combined exercise levels decreased. While the differences between the mean scores for the low-match and moderate-match groups were not significant, the mean scores for both the low-match and moderate-match groups were significantly lower than the mean scores of the high-match group.

While such findings are disappointing in light of the nature of

the hypothesized relationship, such results should, perhaps, not have been entirely unexpected. One explanation for the findings of this study may be that the assumptions upon which the study were based were not warranted. The first and second assumptions were that the Cognitive Style Mapping Interest Inventory Test and the matching routine were valid procedures. The cognitive style instrument and the matching routine have been employed in a number of studies which have reported significant findings. The third assumption was that the communication accuracy exercise would provide a measure of communication accuracy. While this is the only study which had attempted to use this particular exercise, every effort had been made to assure that the exercise would provide some measure of accuracy. The exercise was similar in conceptualization to those used by Leavitt and Mueller (1951), had been pretested with several groups of students, had been judged by members of the faculty of the Department of Communication Arts and Sciences as being similar in concept and design to exercises commonly used as measures of communication accuracy, the diagrams had been rated for complexity, and the scoring of the exercises had been verified by the rescoring of a random selection of the exercises. Therefore, it would seem that the assumptions were reasonable.

Human communication is a highly complex process. The interrelated and interdependent nature of the process makes it difficult, if not nearly impossible, to arbitrarily categorize its components for the purposes of study and analysis. Perhaps it is this very complexity which accounts for the fact that there have been relatively few studies which have attempted to assess directly communication accuracy.

The five sets of variables which Mehrabian and Reed (1968) have concluded are determinants of communication accuracy are: attributes of the channels, attributes of the communication, attributes of the referent, attributes of the communicator, and attributes of the addressee. The attributes of the communicator and of the addressee are viewed as essentially the same and include attitudes, reference groups, culture, language, and modes of cognition. This study attempted to separate out from the variable of communicator-addressee attributes the single factor of cognitive similarity. Based on much of the prior research on communication accuracy such a conceptualization seemed valid as several studies, as noted in Chapter II, have reported general findings that cognitive similarity appeared to be positively related to communication accuracy. Newcomb (1953, 1956, 1958), Runkle (1956), and Triandis (1960) have all hypothesized such a relationship. It should be noted, however, that the method of determining cognitive similarity was generally indirect, i.e., inferred from some other measure of similarity. Runkle used as a measure of accuracy students' grades on course examinations, a method which is an indirect measure of communication accuracy.

Additional findings which perhaps permit a better understanding of the findings of the present study were those of Feffer and Suchlotiff (1966), Lantz and Stefflre (1964) and Triandis (1960). Feffer and Suchlotiff looked at cognitive similarity and communication accuracy and concluded that language usage as reflected in the verbal fluency scores and in vocabulary scores was not significantly related to cognitive similarity or to communication accuracy. Lantz and Stefflre's study of the relationship between language and communication accuracy

found that there was no relationship between similarity of language and communication accuracy. They stated that the common assumption about the relationship of similarity of language and communication accuracy is not justified. Finally, Triandis reported that both attribute similarity and communication (language) similarity were positively related to communication accuracy, but that the two kinds of similarity were not positively correlated.

The awareness that language similarity does not seem to be related to communication accuracy may permit the development of a rationale which may help to explain the findings of the present study. Language, any language, is a symbol system in which both abstract and concrete referents are represented by symbols. Cognitive style has previously been defined as the cartesian product of the three sets: symbols and their meanings, the cultural determinants of the meanings of symbols, and the modalities of inference. Two of the four theoretical symbols which make up the set of symbols and their meaning are auditory symbols: T(AL) Theoretical Auditory Linguistic--the ability to acquire meaning through hearing spoken words and T(AQ) Theoretical Auditory Quantitative--the ability to find meaning in terms of numerical symbols, relationships, and measurements that are spoken. It would appear that the auditory linguistic and the auditory quantitative are exactly the skills which the students-addressees would have required to be successful with the communication accuracy exercise. In addition to the auditory skills the teacher-communicator would have had to employ the remaining theoretical symbols: T(VL) Theoretical Visual Linguistic--the ability to find meaning from the written word, and the

T(VQ) Theoretical Visual Quantitative--ability to acquire meaning in terms of numerical symbols, relationships, and measurements.

Three inferences are possible. Perhaps a major portion of the Cognitive Style Mapping Interest Inventory Test is in actuality a test of symbol or language usage. Perhaps only the first set, symbols and their meanings, should have been selected as predictors of communication accuracy. Perhaps accuracy should not have been predicted on the basis of how closely student-teacher profiles matched, but on the degree to which the instructors had a cognitive style which utilized the theoretical visual modes and the degree to which the students employed the auditory modes.

If the cognitive style instrument is in reality primarily a test of language usage, based upon prior findings it would not be surprising to find that a positive degree of correspondence between two styles is not related to communication accuracy. On the other hand, possibly only those selected elements of the cognitive style instrument which appear to be germane to the nature of the communication accuracy exercise should have been employed. Finally, it is possible that the results which were found by this study may have been due to the fact that certain of the instructors simply did a better job of describing the figures, and certain students seemed to do a better job of reproducing the figures. It is perhaps possible that the task of encoding the message required cognitive abilities which were different than the skills required for the decoding of the message. If this is the case, the effect of cognitive style match would have been obscured. Looking at the findings of the study from a different point of view, it is possible that the elements

associated with the accuracy exercise may have contributed to the nature of the results. While the assumption that the accuracy exercise would provide a valid measure of communication accuracy seemed to be justified, perhaps the task of reproducing the drawings was not the best possible measure of accuracy and that some other measure of accuracy should have been employed. It is also possible that judging errors or bias distorted the accuracy exercise scores even though an effort was made to verify the scoring.

Implications For Future Research

Although the data and their analysis do not bear out the hypothesized relationships it would be unwarranted to suggest that this line of investigation should not be continued. Communication accuracy and cognitive style as variables in human behavior are difficult to measure accurately, and it is quite likely that students of human behavior have not as yet devised perfect instruments for the measurement of these variables; however, these difficulties should not prevent researchers from continuing their efforts to understand both factors and their possible relationship. The following suggestions for future research on the relationship between cognitive similarity and communication accuracy are made based upon insights gained from the present study.

1. Replicate the present study with larger sample sizes.

2. Correlate cognitive style and some other variable such as course grades or vocabulary test scores with communication accuracy.

3. Use only selected elements of the cognitive style instrument, e.g., the set of symbols and their meanings.

4. Shorten the communication accuracy exercise to only one or two diagrams.

5. Lengthen the communication accuracy exercise to six or eight diagrams possibly spaced over a period of several days or weeks.

6. Try some other measure of communication accuracy such as recall or cloze procedures.

7. Establish absolute categories of cognitive similarity rather than partitioning the obtained distribution, e.g., only those profiles with a percentage of match greater than 72% will be considered as a "high" match.

8. Determine if there are identifiable communicator cognitive styles which seem to be more effective in communicating accurately by comparing the exercise scores of the students of the various instructors.

9. Have each instructor give the exercise directions to more than one group of students.

10. Determine if there are identifiable addressee cognitive styles which seem to be more successful in decoding accurately by comparing the styles of the group of students who do well on the accuracy exercise with those groups of students who score moderately well and those who score poorly on the communication accuracy exercise.

APPENDIX A

SAMPLE STATEMENTS FROM THE

COGNITIVE STYLE MAPPING INTEREST INVENTORY

APPENDIX A[1]

SAMPLE STATEMENTS FROM THE COGNITIVE STYLE MAPPING INTEREST INVENTORY

1. Theoretical Auditory Linguistic

   I can make more sense out of what a person means when he speaks to me rather than when he writes to me.

2. Theoretical Auditory Quantitative

   I find it comfortable to add spoken or dictated numbers mentally.

3. Theoretical Visual Linguistic

   I understand more easily when I read information rather than when I hear it.

4. Theoretical Visual Quantitative

   I find it necessary to write down a telephone number as soon as I hear it because I cannot remember it.

5. Qualitative Auditory

   I can tell the difference between two closely pitched sounds.

6. Qualitative Olfactory

   The aroma in a room determine for me whether it is a pleasant or unpleasant place.

7. Qualitative Savory

   Blindfolded, I can taste the difference between chocolate and coffee ice cream.

8. Qualitative Tactile

   I prefer the furniture that I enjoy running my hand over.

---

[1]Niles (1974).

9. Qualitative Visual

   I prefer to read articles which are illustrated by pictures or drawings.

10. Qualitative Proprioceptive

    I can play ping pong well enough to enjoy it.

11. Qualitative Code Empathetic

    I can be patient with the inability to concentrate which characterizes those who are newly "in love."

12. Qualitative Code Esthetic

    I enjoy the author's writing style as much as the story he tells.

13. Qualitative Code Ethic

    I would give up monetary gain to avoid a compromise of principles.

14. Qualitative Code Histrionic

    I am able to "play a role" anywhere if I agree to.

15. Qualitative Code Kinesics

    I "talk with my hands" more than others do.

16. Qualitative Code Kinesthetics

    I am better coordinated than most people.

17. Qualitative Code Proxemics

    I can recognize those who will welcome friendly overtures from me.

18. Qualitative Code Synnoetics

    I know my strengths and weaknesses.

19. Qualitative Code Transactional

    I am able to put people at ease in tense situations.

20. Associates Determinant

    Before taking a new job, I would discuss it with my friends.

21. Individuality Determinant

    I do not need others to help me make decisions.

22. Family Determinant

I make it a point not to let my work interfere with family plans.

23. Inference of Difference

I "play the devil's advocate" with people to force them to look at another point of view.

24. Inference of Appraisal

The more I know about a problem, the more I want to know about it.

25. Inference of Relationship

I tend to see all parts of the world as being interconnected.

26. Inference of Magnitude

I prefer working in situations where standards and rules are stated explicitly.

27. Deductive Inferential Pattern

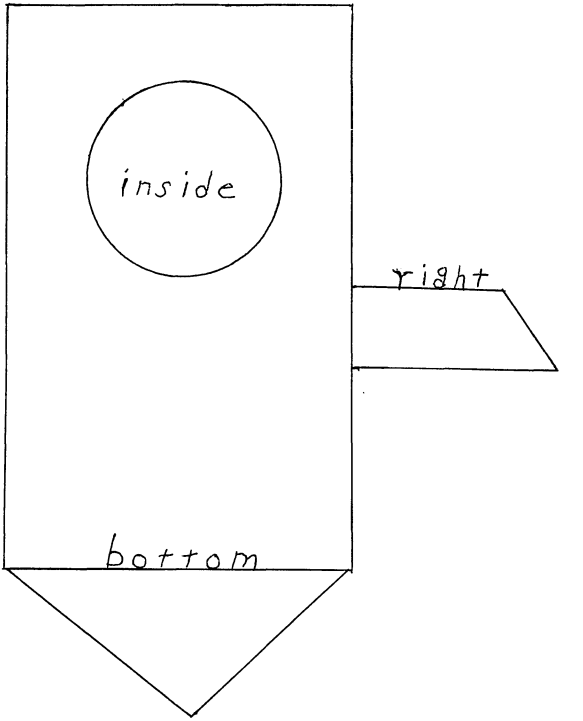
I find it easier to win an argument when I state a premise and give a conclusion which is inescapable: (Blank is true, therefore Blank must be true.)

APPENDIX B

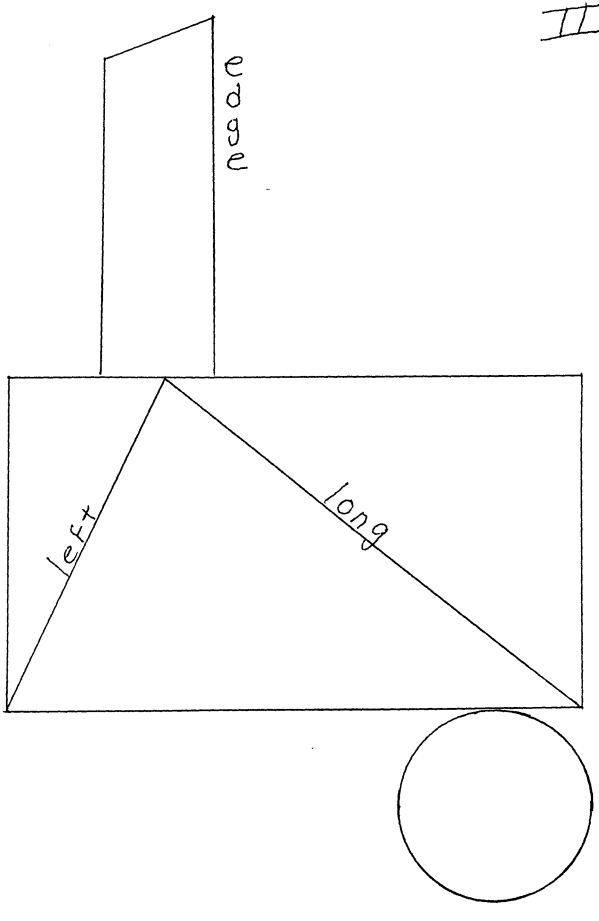
COMMUNICATION ACCURACY EXERCISE SET

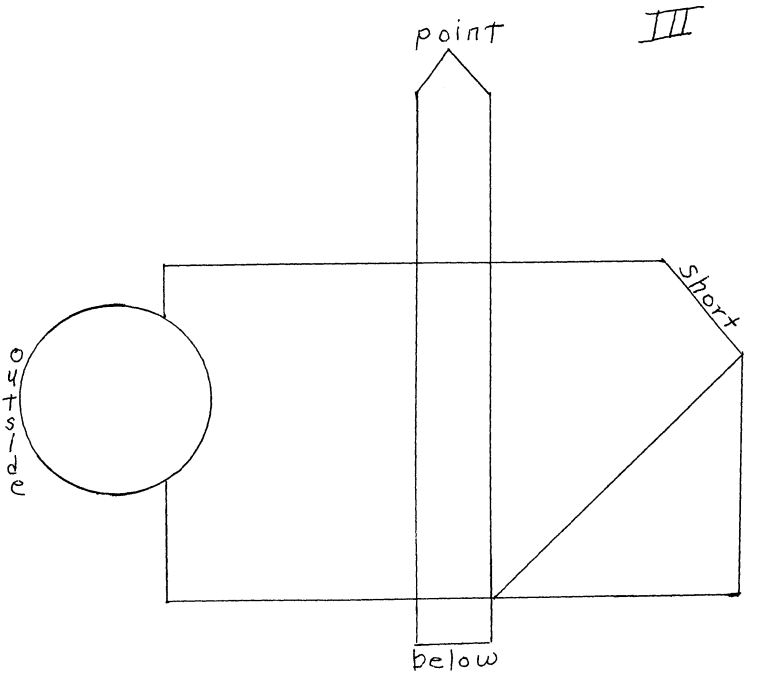
(The following diagrams are exact duplicates of the drawings as they were used in the study.)

I

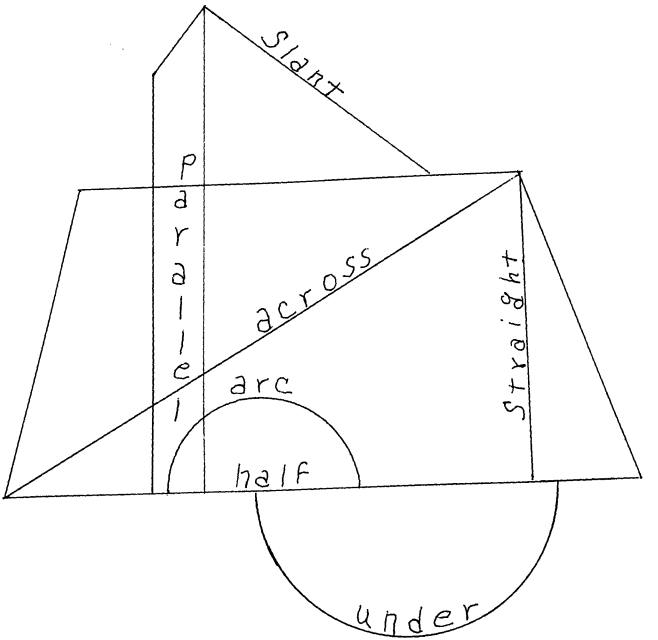


II





IV



APPENDIX C

A SUGGESTED TECHNIQUE FOR DETERMINING DEGREE OF MATCH BETWEEN "STYLES" AND BETWEEN "STYLES" AND "MODES OF UNDERSTANDING"

A SUGGESTED TECHNIQUE FOR DETERMINING DEGREE OF MATCH BETWEEN "STYLES" AND BETWEEN "STYLES" AND "MODES OF UNDERSTANDING"

In the application of the conceptual framework called "the Educational Sciences," the educator is encouraged to participate personally in the processes of observation, assessment, interpretation, and mapping. Techniques which the individual may employ to improve his abilities and outputs in these activities have been presented in connection with such considerations as: reliability, validity, objectivity, and discriminative power of instrumentalities, scaling, item analysis, item construction, and the diagnostic, prescriptive, and clinical aspects of mapping "styles," as well as mapping of modes of understanding required by "tasks." For example, the three Principles for determining either a major, or a minor, or a negligible orientation of a "style" element invokes an approach in which the objectivity, the reliability, the validity, and the discriminative power of both the mathematical and the empirical mapping processes employed by the "mapper" are improved or increased relative to an approach that did not include these Principles.

Although the instrumentalities employed to yield information for the mapping of elements of "styles" are not, by intention, designed to be predictive of an individual's performance in any given system, once the tentative mode of understanding required by the system (e. g., a unit of instruction) with which the individual must interact is "determined," a technique for determining the degree of match between the "style" of the individual and the "mode" required by that system has proven to be most beneficial, not only in diagnostic, prescriptive, and clinical practices, but in the realms of student motivation and achievement, as well. This technique has also been found to be contributory, by determining the degree of match between the "styles" of individuals, in the areas of instruction, administration, counseling, and the reduction of dissonance being witnessed by an individual in connection with certain persons, or processes, or properties, or any combination of these elements in the system with which he

is interacting.

The "matching" technique suggested here is illustrated in terms of a step-by-step procedure for determining the degree of match between the cognitive styles of Individual A and Individual B, respectively. Although the procedure is illustrated in terms of "matching" the cognitive styles of two individuals, it can be used equally effectively to match the "style" of an individual with a mode of understanding required by a given "task," to determine the match between the administrative style of an individual and the role expectancy, expressed in "style" elements, of the administrative position he holds; and a variety of other matches involving teaching style, counseling style, "preferred" teaching style, and "preferred" administrative style to mention but a few of the possibilities. The step-by-step procedure is as follows:

Step 1. Determine which "style" or "mode" is the one to be used as the referent in the "matching" process. This decision is not an arbitrary one. For example, in determining the degree of match between the cognitive style of a student and the cognitive style of the teacher, unless some type of exceptional circumstance exists, the teacher's "style" would be selected as the referent. In this example, it is assumed that the cognitive style map of Individual A will be the referent.

Step 2. Basically the system of matching suggested here is one of assigning a value of 3, 2, 1, or 0, to each element in the "style" of the individual being matched with the referent "style."* The referent style is scored by assigning the value of 3, only, to each of its elements, except that of L, the "appraisal modality

*It should be recalled here that a score is defined to be a value assigned to an act or quality. In this context, assigning values to the elements of "style" is an act of scoring that style.

of inference," which, when it occurs in the "referent," or in the "style" being matched with the referent, should be assigned the value 9. To illustrate this point, suppose that the cognitive style map of Individual A, the referent "style," is as shown below:

(12)-3	(10)-3	(12)-3						
T(AL)-3	T'(AQ)-3	T(VL)-3						
Q(CET)-3	--	--		F-3		R-3	L-9	"Referent / Style"
Q(CEM)-3	--	--	X	I'-3	X	M'-3		= g of
Q(CES)-3	--	--		A'-3		D'-3		Individual A
Q(CP)-3	--	--						
Q'(CH)-3	--	--						

RDLVL - 12.2-3

Test No.	Element	Per. Range	Test No.	Element	Per. Range	Element	Per. Range	Element	Per. Range
1	T(VL)	70-79	7, 8	Q(CEM)	70-79	Q(CES)	60-69	Q(CET)	80-89
2	T(AL)	60-69		Q(CH)	30-39	Q(CK)	20-25	Q(CKH)	20-25
3	T(VQ)	10-19		Q(CP)	60-69	Q(CS)	10-19	Q(CT)	20-25
4	T(VL)	70-79	9	I	40-49	A	30-39	F	60-69
5	T(AQ)	40-49	10	M	40-49	D	30-39	R	60-69
6	T(VL)	80-89		L	70-79				

It should be noted that each of the respective levels of educational development, 12 for T(AL) and for T(VL), and 10 for T'(AQ), along with reading level - 12.2, is assigned a value of "3" as well as each of the other elements in the "referent style."

Step 3. Assign a value of 3, 2, 1, or 0 to each "element" of the "style" map of Individual B, according to the following rules of assignment (algorithms).

I. If the Level of Educational Development to be scored is: (a) one level below, (b) the same, or (c) higher than its counterpart "level" in the referent style, then assign a value of "3" to this element.

II. Apply Rule I to Reading Level.

III. If the Level of Educational Development to be scored is: (a) two levels below, or (b) three levels below its counterpart level in the referent style, then assign a value of "2" to this element.

IV. If Rule I does not apply to Reading Level, then apply Rule III to it.

V. If the Level of Educational Development to be scored is: (a) four levels below, or (b) five levels below its counterpart level in the referent style, then assign a value of "1" to this element.

VI. If Rule I and Rule III do not apply to Reading Level, then apply Rule V to it.

VII. If the Level of Educational Development to be scored is more than five levels below its "counterpart" in the referent style, then assign a value of "0" to it.

VIII. If the Reading Level to be scored is more than five levels below its counterpart in the referent style, then assign a value of "0" to it.

IX. With the exception of the elements of: Level of Educational Development, Reading Level, and the Appraisal (L) Modality of Inference, if the element to be scored shows the same percentile range, or in the case of composite elements, the same "average" percentile range, as its counterpart element

in the referent style, then assign a value of "3" to it. In the case of an element such as T(VL), a composite variable, the midpoint value of each percentile range included in the "composite" is used to calculate an average percentile value which then is used to establish an appropriate "average" percentile range which can be compared with its counterpart "average" percentile range in the referent style. If the condition covered by this Rule holds for the "Appraisal (L)" element to be scored, then assign a value of "9" to it. The elements of Level of Educational Development and Reading Level, respectively, are covered by Rules I-VIII.

X. If the orientation of the element, i. e., a "major," or a "minor," but not a "negligible," to be scored is the same as its counterpart element in the referent style, but its percentile range, or in the case of composite elements, its "average" percentile range is not the same as its counterpart element in the "referent," then assign a value of "2" to it. If this condition holds for the "Appraisal (L)" element to be scored, then assign a value of "6" to it.

XI. If the orientation of the element, i. e., a "major," or a "minor," but not a "negligible," to be scored is different from its counterpart element in the referent style, then assign a value of "1" to it. Since minor and negligible orientations in the "Appraisal (L)" element are not shown in the cognitive style map, this Rule does not pertain to it. In this context, if an element has a negligible orientation, it is not shown in the map and therefore this Rule would not apply to it as well.

XII. Except for the "Appraisal (L)" element, if the element to be scored does not have a counterpart element in the referent style, then assign a value of "0" to it. In the case of the "Appraisal (L)" element, if its counterpart "L" does not occur in the referent style, but a "double-eigen" involving the other "modalities" does occur, then assign a value of "6" to it. If the countepart "L" does not occur in the referent style, but a "single-eigen" condition exists, then assign a value of "3" to it.

To illustrate how these Rules are employed, the elements in the cognitive style map of Individual B are scored accordingly:

(9)-2 (10)-2 (6)-1

T'(VL)-1 T(AL)-2 T'(AQ)-2

Q(CEM)-3	--	--					
Q(CP)-3	--	--					
Q(CET)-2	--	--	X	F-3 A-1	X	D-1 L-6	= g of Individual B
Q(CS)-0	--	--				M'-2	
Q(CES)-2	--	--				R'-1	
Q'(CK)-0	--	--					
Q'(CH)-3	--	--					

RDLVL - 8.6-2

Test No.	Element	Per. Range	Test No.	Element	Per. Range	Element	Per. Range	Element	Per. Range
1	T(VL)	30-39	7, 8	Q(CEM)	70-79	Q(CES)	50-59	Q(CET)	60-69
2	T(AL)	50-59		Q(CH)	30-39	Q(CK)	30-39	Q(CKH)	10-19
3	T(VQ)	10-19		Q(CP)	60-69	Q(CS)	50-59	Q(CT)	20-25
4	T(VL)	0-9	9	I	20-25	A	60-69	F	60-69
5	T(AQ)	26-29	10	M	30-39	D	60-69	R	26-29
6	T(VL)	40-49		L	50-59				

Since the Level of Educational Development for the T(VL) eigen in the referent style is (12), while in Individual B's map the "Level" for the T(VL) eigen is (9), Rule III applies and the value of "2" is assigned to that "Level." Since the "Level" of (10) is associated with the T(AL) eigen of Individual B's map, while the "Level" of that eigen in the referent style is (12), Rule III applies once again, and the value of "2" is assigned to that "Level." The Level of Educational Development (6) associated with the T(AQ) eigen in Individual B's map is four levels below the T(AQ) eigen in the referent style. Under these circumstances, Rule V applies, and a value of "1" is assigned to this "Level." Since Reading Level 9 is defined by Levels from 8.5 through 9.49, respectively, the "Level" 8.6 shown in B's map is defined to be at "Level" 9. In this context, B's Reading Level is three levels below the 12.2 Reading Level shown in the referent style. Accordingly, Rule IV (which applies Rule III to Reading Level) pertains to this situation, and a value of "2" is assigned to the Reading Level of 8.6.

Noting that the element theoretical visual linguistic is a minor orientation, T'(VL), while in the referent style it is a major orientation, T(VL), Rule XI applies, and a value of "1" is assigned to that element in B's map. If T(VL), a "composite," had been a minor orientation in the referent, then it would have been necessary to find the value of the arithmetic average (the mean) of the midpoints of the percentile ranges associated with the T(VL) measures, Tests 1, 4, and 6, respectively, included in the composite, found in B's map. Had this been the situation, the midpoint values would have been 34.5 for the range 30-39 associated with Test 1, 4.5 for Test 4, and 44.5 for Test 6. The average of the midpoints would have been: $\frac{34.5 + 4.5 + 44.5}{3} = \frac{83.5}{3} = 27.8$. This value, by definition, would be associated with the "average" percentile range of: 26-29. The value of the "average" percentile range of the supposed T'(VL) in the referent style would then have been calculated in the same fashion. If the "average" percentile ranges had been the same, then by Rule IX, a value of "3" would

have been assigned to T'(VL) in B's map. If these "ranges" were found to be different from each other, then according to Rule X, a value of "2" would have been assigned to T'(VL) in B's map.

Since T(AL) in B's map is the same orientation, a "major," as that of the T(AL) element in the referent style, but the percentile range, 50-59, for T(AL) in B's map is different from the range, 60-69, for T(AL) in the referent style, Rule X applies and this element in B's map is assigned a value of "2." It was not necessary to calculate an "average" percentile range for T(AL) in this case, because this element is not a composite variable as measured by the particular battery employed to produce the referent style (Individual A's map) and Individual B's map shown in this example. Had T(AL) been a composite variable, it would have been noted as such in the map, and the procedure for determining "average" percentile ranges for this element in the referent style and in B's map would have been employed.

In the case of the element, theoretical auditory quantitative, a minor orientation, T'(AQ), occurs in B's map and also in the referent style. The percentile ranges of these elements, however, are different from each other. Therefore, Rule X applies, and a value of "2" is assigned T'(AQ) in B's map. Since T(AQ) is not indicated to be a composite variable, there is no need to determine an "average"percentile range for this element.

Assuming that none of the other elements in the respective "styles," i. e., in the "referent" and in Individual B's, is a composite variable, the following table shows the element, the Rule, and the value assigned to that element in Individual B's map:

Element	Rule	Value	Element	Rule	Value	Element	Rule	Value
Q(CEM)	IX	3	Q(CP)	IX	3	D	XI	1
Q(CES)	X	2	Q(CS)	XII	0	M	X	2
Q(CET)	X	2	A	XI	1	R	XI	1
Q(CH)	IX	3	F	IX	3	L	X	6
Q(CK)	XII	0	I 0, (Does not appear in B's map)					

Step 4. After the elements in the map being matched with the referent are scored, the total number of points associated with each of the following sets of elements, in both the referent style and in the map being matched to it, must be determined: (a) the Levels of Educational Development and the Reading Level, (b) the combinations of elements in the set Symbols and their Meanings, (c) the "combinations" in the set Cultural Determinants of the Meanings of Symbols, and (d) the combinations in the set Modalities of Inference. To illustrate this procedure, (a) the total points associated with the Levels of Educational Development and the Reading Level in the referent style would be: Eigen T(AL)(12)-3; Eigen T(VL)(12) - 3; Eigen T'(AQ)(10) - 3; and RDLVL (12.2) - 3; or 3+3+3+3 = 12 points. While in Individual B's map, the total number of points associated with these "Levels" would be: Eigen T(AL)(10)-2; Eigen T'(VL)(9)-2; Eigen T'(AQ)(6)-1; and RDLVL (8.6)-2; or 2+2+1+2 = 7 points.

(b) Since all the elements in the set Symbols and their Meanings are binomial combinations of the form: (T-Q), or (T-Q'), or (Q-T'), or (T'-Q'), where the symbol (') denotes a minor orientation, the points for the theoretical symbol (T) involved in the combination are added to those for the qualitative symbol in that "binomial," unless the value assigned to either the theoretical (T) or the qualitative (Q) is "0." In this latter case, but only in the set Symbols and their Meanings, the total number of points associated with such a binomial is defined to be "0." This approach avoids a spuriously high total number of points in this set of an Individual's map, deriving from the repeated addition of a particular theoretical symbolic orientation (T) in combination with a series of qualitative orientations (Q's) that may have been assigned the value of "0." The values of

the binomial combinations are then totalled for each eigen, and these values, in turn, are added together to find the total number of points associated with the set Symbols and their Meanings. To illustrate, in the referent style, for the T(AL) eigen, each of the five binomial combinations: [T(AL) - Q(CET)], [T(AL) - Q(CEM)], [T(AL) - Q(CES)], [T(AL) - Q(CP)], and [T(AL) - Q'(CH)] equal: 3 + 3 = 6 points. Since there are five of these "combinations" and each one yields 6 points, the total for the T(AL) eigen becomes, 5 x 6 points = 30 points. In similar fashion, the T'(AQ) eigen yields 30 points, as does the T(VL) eigen. Consequently, the total number of points for the set Symbols and their Meanings, in the referent style, is: 3 x 30 points = 90 points. In Individual B's map, the "combinations" of: [T'(VL) - Q(CEM)], [T'(VL) - Q(CP)], and [T'(VL) - Q'(CH)] yield: 1+3 = 4 points each, or a total of: 3 x 4 points = 12 points; while each of the "combinations" of: [T'(VL) - Q(CET)] and [T'(VL) - Q(CES)] yields: 1+2 = 3 points, or a total of: 2 x 3 points = 6 points. It should be particularly noted that each of the "combinations" of: [T'(VL) - Q(CS)] and [T'(VL) - Q'(CK)], although ostensibly yielding the value: 1+0 = 1 point, is defined to yield "0" points in order to avoid a spuriously high accumulation of points based upon the repeated use of the same element, in this case T'(VL). In the case of the T(AL) eigen, each of the combinations of: [T(AL) - Q(CEM)], [T(AL) - Q(CP)], and [T(AL) - Q'(CH)] yields: 2+3 = 5 points, or a total of: 3 x 5 points = 15 points; while each of the "binomials" of: [T(AL) - Q(CET)] and [T(AL) - Q(CES)] yields: 2+2 = 4 points, or a total of: 2 x 4 points = 8 points. Each of the "combinations" of: [T(AL) - Q(CS)] and [T(AL) - Q'(CK)] is defined to yield "0" points for the reasons given in the cases of [T'(VL) - Q(CS)] and [T'(VL) - Q'(CK)], respectively. Since the element T'(AQ) was assigned the

same value, "2," that the element T(AL) was in B's map, the total points yielded by the T'(AQ) eigen will be equal to the total number of points yielded by the T(AL) eigen in B's map; i. e., 15 + 8 = 23 points, each. The total number of points yielded by the three eigens in the set Symbols and their Meanings of B's map is: T'(VL) eigen - 18; T(AL) eigen - 23; T'(AQ) eigen - 23, or: 18 + 23 + 23 = 64 points.

(c) The total number of points yielded by the (F) eigen in the "Cultural Determinants" set of the referent style is: F = 3 points, (F - I') = 3 + 3 = 6 points, (F - A') = 3 + 3 = 6 points; or 3 + 6 + 6 = 15 points. The total number of points yielded by the double-eigen array in the "Cultural Determinants" set of B's map is: F = 3 points, and A = 1 point; or 3 + 1 = 4 points.

(d) In the third set, Modalities of Inference, the total number of points yielded by the (R) eigen and the (L) eigen, in the referent style, is: R = 3 points, (R-M') = 3 + 3 = 6 points, and (R-D') = 3 + 3 = 6 points; or: 3 + 3 + 6 = 15 points; while L = 9 points; and the grand total number of points for this set of elements is: 15 + 9 = 24 points. The (D) eigen and the (L) eigen in B's map yield: D = 1 point; (D-M') = 1 + 2 = 3 points; (D-R') = 1 + 1 = 2 points; or a total of: 1 + 3 + 2 = 6 points, while L = 6 points, so that the grand total number of points for this set is: 6 + 6 = 12 points.

Step 5. With the total number of points determined for: (a) the "Levels," (b) "Symbols and their Meanings," (c) "Cultural Determinants," and (d) the "Modalities," for the referent style, and for Individual B's map, it is now possible to determine the percent o "agreement," or the "match" between each set of the referent style and its counterpart set in Individual B's "style." The values of these percent indices are calculated by

dividing the total number of points associated with a given set in B's map by the total number of points associated with the counterpart of that set found in the referent style. The following calculations illustrate the discussion:

(a) "Levels" - Percent of Agreement = $\frac{\text{Total Points for "Levels" in B's Map}}{\text{Total Points for "Levels" in "Referent"}} = \frac{7}{12} \approx .583$

(b) "Symbols" - Percent of Agreement = $\frac{\text{Total Points for "Symbols" Set in B's Map}}{\text{Total Points for "Symbols" Set in "Referent"}} = \frac{64}{90} \approx .711$

(c) "Determinants" - Percent of Agreement = $\frac{\text{Total Points for "Determinants" Set in B's Map}}{\text{Total Points for "Determinants" Set in "Referent"}} = \frac{4}{15} \approx .266$

(d) "Modalities" - Percent of Agreement = $\frac{\text{Total Points for "Modalities" Set in B's Map}}{\text{Total Points for "Modalities" Set in "Referent"}} = \frac{12}{24} = .50$

Step 6. In order to determine the general percent of agreement, or degree of match, between Individual B's "style" and the Referent Style, Individual A in this example, the arithmetic average or the mean of the percents of agreement found in Step 5 is calculated. In this example:

$$\text{Degree of Match} = \frac{.583 + .711 + .266 + .50}{4} = \frac{2.060}{4} = .515$$

It should be noted that each percent of agreement is given an equal "weighting" in this process. Through this approach, Levels of Educational Development and Reading Level, as one set of information, is accorded one-quarter of the overall degree of match. Obviously, the same "weighting" pertains to each of the other three sets of information involved in the "match," as well.

Step 7. Applying Principle I, II, or III associated with the process of mapping styles, determine the "orientation," i. e., a "major," or a "minor," or a "negligible," of the Degree of Match. In this example with the value of the match being: .515, Principle I would be applied and the "match" would be classified as:

"a Major." It should be noted that a 51.5 percent "match" is a minimum match at best, and any assignment based upon this degree of match should be monitored and subjected to rather frequent analysis.

The seven-step procedure presented here has evolved from a number of doctoral studies and project efforts. Many other approaches (e. g., multiplicative models) have been employed, but this procedure, the latest at this point in time of many additive models, has proven, empirically, to be the most effective one developed to date.

APPENDIX D

SCORING KEY FOR COMMUNICATION ACCURACY EXERCISE

(The following diagrams are exact duplicates of the drawings as they were used in the study.)

APPENDIX D

SCORING KEY FOR COMMUNICATION ACCURACY EXERCISE

Intent. In scoring the communication accuracy exercise the referent drawing is at all times to be the criterion for accuracy; however, the drawings are to be scored with the awareness that the drawings were made without the use of aids such as ruler or compass. Thus if a student clearly intended to draw a figure such as a rectangle the figure is to be scored as accurate even if all lines are not absolutely parallel.

General procedure. The scoring will be conducted using a minus points system.

-3 points for any missing shape

-1 point for any missing part of a shape

-2 points for any shape not in proper relation to the other parts of the diagram

-1 point for any shape grossly mis-sized

-3 points for any total diagram grossly mis-sized

-3 points for any total diagram misplaced on the paper

-1 point for any line or portion of a figure which does not appear in the referent diagram

-3 points for any missing label

-2 points for any label which is incorrectly positioned

-1 point for any label which does not appear in the referent diagram

Labels must appear in the relationship in which they appear in the referent diagrams. They must be left or right of shapes as shown. They must be

written vertically, horizontally, or slanted as shown.

If the shape which is to be labeled is not is proper relationship to the other parts of the diagram, but the labeling of that shape is in proper relationship to that shape as shown in the referent diagram, the labeling of that shape is scored as correct.

Specific procedure

Figure II

1. Figure A is to be a rectangle not a square.
2. Figure B must be above line G-H, must be situated to the left of the middle of line G-H, and must be drawn to that point K is between lines L and M.
3. Line C must slant upward from left to right.
4. Circle D must be below line N, to the right of the mid-point of line N, and must not extend to the right beyond point J.
5. Line E must slant from lower left hand corner to point K on line G-H.
6. Line F must slant from lower right hand corner to point K on line G-H.

Figure III

1. Figure A must be situated so that less than one-half of the figure is inside figure B.
2. Figures C, D, and E must be situated at approximately the middle of the larger figure created by B, D, F, and G.
3. Figure C must be above line H and must be pointed at the top.
4. Figure E must be below line I.
5. Line J must be right of line K and must slant upward from left to right.
6. Line L must slant downward from left to right and must be shorter than line H.

Figure IV

1. Line A must slant inward from bottom to top.

2. Line C must slant inward from bottom to top.

3. Line E must be a straight perpendicular from point H to point O.

4. Line F must be drawn with an upward slant from point G to point H.

5. Lines I and J are to be drawn left of the mid-point of line B (or D) and extend above line B.

6. Lines K and L must come together to form a point as shown, and line L must end at a point left of point H.

7. Half circle M must be above line D and must terminate between points Q and R on line D as shown.

8. Half circle N must be below line D and the arc must begin and end between points R and S and O and P as shown.

Possible points

Set II

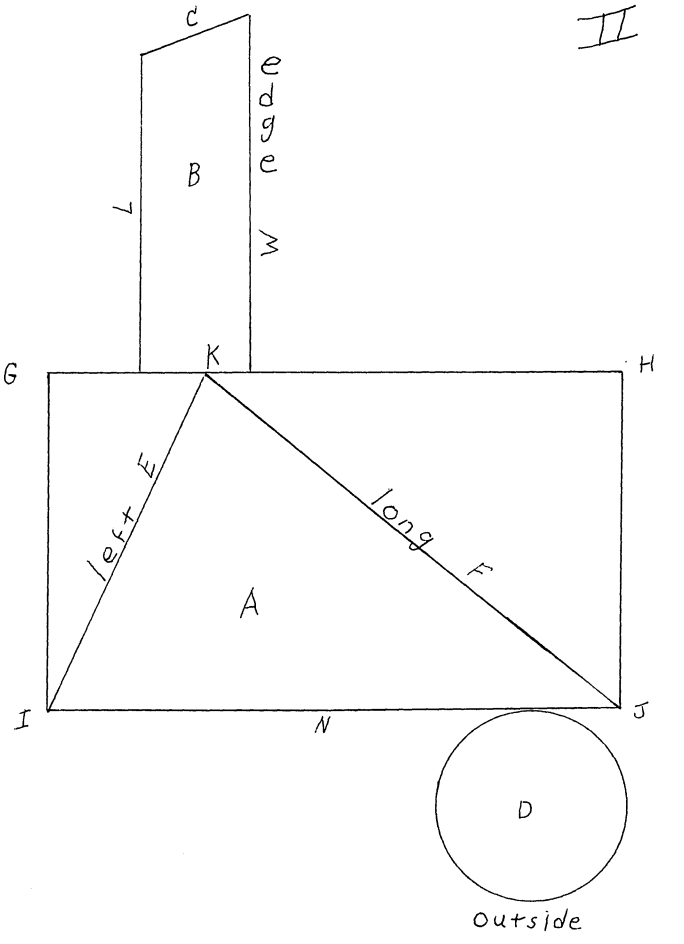
1. Correct shape	1 point	Total possible	5
2. Proper relationship	2 points	Total possible	10
3. Correct label	1 point	Total possible	4
4. Proper relationship	2 points	Total possible	8
		Total Points Possible	27

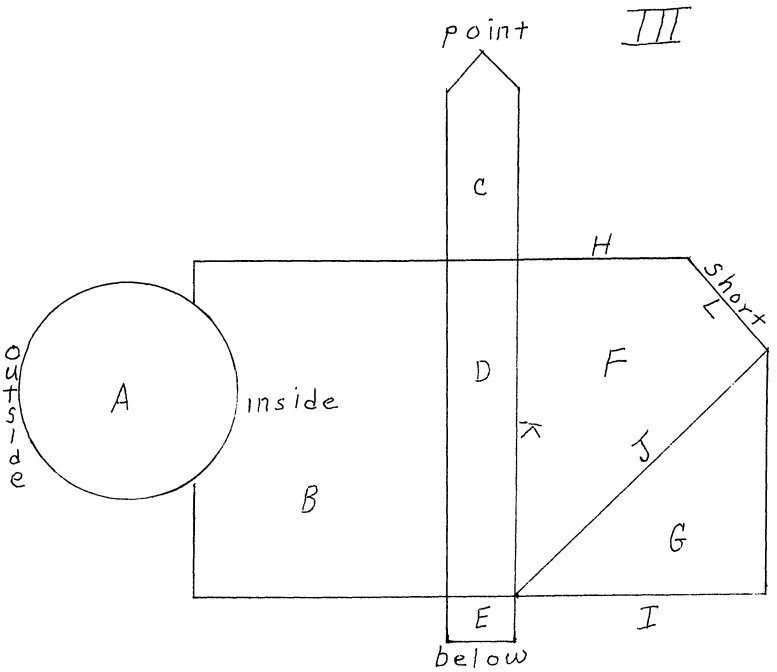
Set III

1. Correct shape	1 point	Total possible	7
2. Proper relationship	2 points	Total possible	14
3. Correct label	1 point	Total possible	4
4. Proper relationship	2 points	Total possible	14
		Total Points Possible	36

Set IV

1. Correct shape	1 point	Total possible	8
2. Proper relationship	2 points	Total possible	16
3. Correct label	1 point	Total possible	4
4. Proper relationship	2 points	Total possible	14
		Total Points Possible	45





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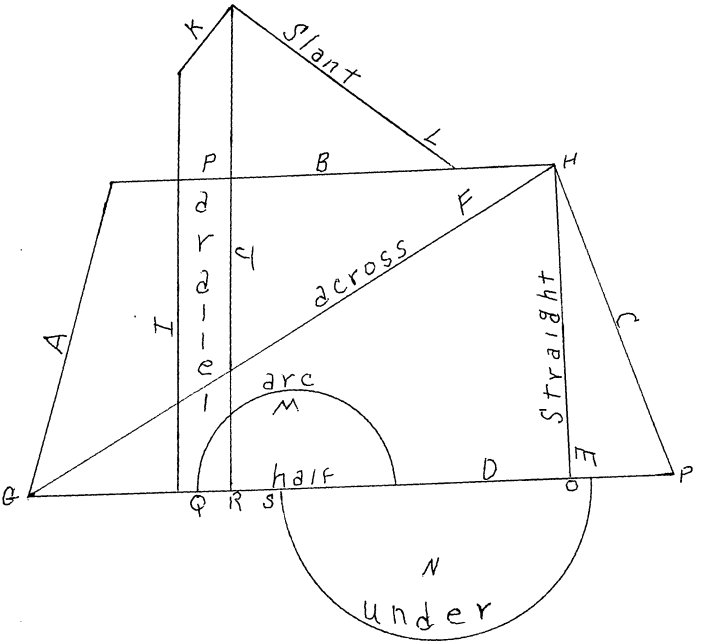

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