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THE DIMENSIONS OF CHILDREN'S MEANING SPACE

by

Peter O. Evanechko

A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled THE DIMENSIONS OF CHILDREN'S MEANING SPACE submitted by Peter Orest Evanechko in partial fulfilment of the requirements for the degree of Doctor of Philosophy

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ABSTRACT

Most learning involves verbal concepts. The learner perceives his reality largely through the selective conceptual system which is his language. The purposes of this study, therefore, were to investigate the nature of semantic processes and the concept of semantic space.

Meaning of concepts was considered to reside in the individual's semantic space. This hypothetical construct was believed to be comprised of a number of dimensions, ways of ascribing meaningful qualities to concepts in the process of signification or labelling. A new test, the Semantic Features Test, developed for this study was used to index this semantic space. The paired comparisons instrument was comprised of twenty-four categories of meaning found to be present in children's meaning responses.

The investigation revealed that the responses of the older Ss more nearly approximated those of an adult. Within each grade, the Ss responses were not random reflecting real semantic behavior. Between grades differences suggesting greater depth in meaning for the older Ss were identified in the way categories of meaning comprising the Semantic Features Test were used.

The study revealed that there was a greater amount of correlation between the Semantic Features Test (SF) and the verbal subtests of the California Test of Mental Maturity (CTMM) than the non-verbal subtests of the same test. Also revealed was the greater correlation for the

younger, Grade V, Ss as compared to the Grade VIII individuals. The higher correlation of the SF test with the verbal subtests of the CTMM attested to the construct validity of the experimental instrument while the lowered correlation at the Grade VIII level indicated a differentiation of cognitive abilities in the older Ss.

Among the general findings of the study it was noted that the younger Ss showed dimensions of meaning which were qualitatively inferior to the meaning dimensions of the older Ss. These dimensions emphasized attributes and characteristics of concepts along with the individual's personal experience with them. The older Ss tended to place more emphasis on the class membership categories of meaning, including them in a majority of their dimensions.

The Individual Differences Model Multidimensional Scaling identified several "idealized individuals." Certain personal characteristics of these composite "persons" were noted. Those with a less adequate semantic space were younger, more likely to live in a small town than in cities or on farms, their parents rated lower on the SES scale, they rated lower on measures of intellectual ability and they may be of either sex.

It was judged that the findings were sufficiently supportive of the semantic space concept and the validity of the Semantic Features Test to suggest their broader application. Also indicated were new ways of organizing learning activities and selecting educational materials in the elementary and junior high schools in Alberta.

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CHAPTER I

INTRODUCTION TO THE STUDY

I. INTRODUCTION

Numerous attempts have been made to define meaning and to subject it to measurement. For educators this problem usually falls under the rubric vocabulary. Vocabulary research has generally proceeded in two major directions, one of which has been concerned with vocabulary in terms of quantity. In 1921 Thorndike published his Teacher's Word Book, the largest of the many word counting projects. After Thorndike's work it was possible to combine data about numbers of words and frequency of occurrence to arrive at some developmental pattern, but determining the size of the vocabulary did not solve the whole problem. Watts recognized this when he wrote:

> It is clear, therefore, that vocabulary research will have to take into account to an increasing extent the range and quality of words which children use, and this will mean that the attempt must be made to classify the kinds of words acquired at different ages and an account given of what it implied by the results of such classification (Watts, 1947, p. 31).

Thus, a second area of vocabulary research has been the qualitative or psychological aspect of vocabulary. Feifel and Lorge (1950), Annett (1959), Burns (1960) and other researchers have attempted to move in this direction.

While studies such as these have opened up a new

direction in vocabulary measurement, they are all prone to the same problems, subjectivity of rater judgment and the time factor. These problems arise from the method employed in assessing children's vocabularies, i.e., categorizing definitions and analyzing them for psychological content. Nor are conventional vocabulary tests more adequate. In these instruments, the subject is invited to give direct or indirect expression to his understanding of words. Unfortunately,

> ... even in the case of tests where the subject must supply a definition of the words, it is not always clear whether he is being tested for knowledge of the word or for skill in definition (Church, 1961, p. 172).

The attainment of meaning of words and concepts is determined in part by the individual's capacity to process sensory data. In this process, it was postulated that the individual uses a set or strategy comprised of certain aspects or dimensions of meaning. These dimensions enable him to organize potentially meaningful materials within the limits of his cognitive organization. For example, a child or an uneducated adult will respond differently (both covertly and overtly) to instances or words standing for instance of such phenomena as; electricity, fact, car, etc., than will an individual who has had intellectual training and a variety of experiences with these referents. This occurs because different dimensions of relevance have been conditioned to the environmental or linguistic stimuli enabling the individual to perceive different qualities

of these stimuli and different relationships among them. The latter individual can now ascribe a more adequate kind of meaning to these stimuli.

In investigating children's vocabulary, little attention has been directed to the development of instruments for identifying and delineating the characteristics of their semantic competence. Identifying such constituents of cognitive functioning would provide much information about the child's qualitative knowledge of words. Also, the creation of a standard pencil and paper test to accomplish the classification of definitions into meaning dimensions would remove much of the subjectivity and decrease the amount of analysis associated with such measurement at present. In this study, the individual's semantic competence was considered to result from and be defined by his semantic space, a concept denoting the organization of semantic relationships into ways of ascribing meaning to words.

Findings of such a study would be important for several reasons. Throughout life, the concepts which an individual develops are primarily manifest in his vocabulary. An individual's vocabulary of signs or symbols is crucial to adequate communication. Vocabulary training is an important part of any educational program since it is related to concepts developed and experiences undergone. Finally, a study of vocabulary is necessary for an understanding of human behavior.

II. THE PROBLEM

One of the most significant and potentially influential problems in vocabulary development is the need for improvement in measures of word meaning. The study of the meanings of words is concerned with establishing the relationship of the words as symbols to things, situations, and behaviors. Most specifically, the educator is concerned with determining the student's knowledge of the relationship between verbal symbols and that which they stand for, their significates. A knowledge of vocabulary is prerequisite to comprehension of most educational endeavors. This study of word meaning was therefore concerned with the role of the organism in mediating or processing the relation between the symbol and the significate.

> The teacher who seeks to build concepts in the pupil's mind is constantly confronted with the problem of determining how well the pupil understands each term, yet vocabulary tests in the past have rarely been diagnostic. Furthermore, they have generally assumed that a word is either known or unknown, so that a simple test can determine the percentage of the class knowing each word (Cronbach, 1943, p. 528).

More careful consideration of the problem of word meaning suggests that individuals know words more or less fully and that testing should determine how the word is known. It is important to discover how individuals process or know verbal stimuli, i.e., the variety, depth, and precision of word meaning. One task of vocabulary measurement must be to identify the dimensions which make up an individual's meaning space and produce his concepts

of the significates identified by words. Therefore, the problem in this study which was of an exploratory nature was to determine whether children's meaning responses could be explained on the basis of a multidimensional meaning space.

Russell contends that a concept is not a word. "However, a concept involves a word or phrase, or some other sign or symbol ..." (Russell, 1956, p. 118). The process by which words come to stand for or correspond to concepts can be described in psychological terms as a sort of reinforcing condition that identifies the word as being associated with a particular concept. To determine meanings of words held by individuals one should identify the possible kinds of interpretations that the individual can make of experience in its verbal form. This procedure would provide the dimensions of meaning which he can use to examine words. These dimensions of meaning will be similar to the psychological processes used to analyze other sensory data in order to develop concepts. The development of factorial methods makes it possible to attack and define some of these fundamental psychological processes which have hitherto resisted analysis.

The investigator hypothesized that to identify the dimensions of an individual's semantic space, i.e., the means by which he processes verbal stimuli, it was necessary to use some index of the individual's logico-semantic functioning. The scaling of a large number of semantic relations by the subject provided this index. Coupled with

a multidimensional scaling procedure for analysis, this activity by the subject provided dimensions of cognitive functioning adequate to serve as a description of his semantic space. The Semantic Features Test (SF), an instrument developed by the investigator, was used in the study to obtain these dimensions of meaning.

The study, therefore, attempted to validate certain procedures for identifying the basic dimensions of word meaning for elementary school children. Other investigators (Feifel and Lorge, 1950; Annett, 1959; Burns, 1960) have assigned children's meaning responses to qualitative dimensions on the basis of certain logical and semantic criteria. Such categorization revealed developmental trends in children's verbal behavior. The present study sought a similar end but rather than having the experimenter assign responses to categories (with all the problems inherent in this procedure) the subjects themselves were required to make this decision through a ranking activity. The dimensions identified, it was postulated, would serve to describe the process by which children ascribe meaning to words.

III. PURPOSES OF THE STUDY

The major purpose of this study was to develop and validate a technique for indexing the child's verbal functioning in order to identify and define the nature of the strategies or processes used to ascribe meaning to words

and concepts. A subsidiary purpose was to investigate the influence of certain conditions affecting the individual's meaning structure.

IV. DEFINITION OF TERMS

A number of terms used throughout the study were defined operationally for the purposes of this investigation. Other terms of more limited reference were defined when introduced.

Meaning was considered to consist of verbal mediating responses in conceptual behavior. These mediating responses, having both response and stimulus properties, were postulated to be organized along several dimensions of logico-semantic relations. It was further postulated that these dimensions constituted the strategy or the set of conditioned behaviors used by the individual in interpreting linguistic data. This includes both connotative and denotative meaning.

Semantic space was a postulated n-dimensional space taken to identify the individual's verbal mediating responses and to describe the process or strategy applied by the individual in the assigning of meaning to verbal data. This space was considered to be Euclidian in nature possessing a varying number of orthogonal dimensions. These dimensions define the limits of this space and are the kinds of logico-semantic relations the individual can conceptualize as existing between sensory data and

linguistic symbols.

Multidimensional scaling was a method for providing information about the dimensions of the area being investigated. The basic notion is one of an underlying multidimensional space where the stimuli (words) are represented by points in a space of several dimensions (Torgerson, 1958, p. 248). Distinction is made between a quantity and an object on the one hand, and an attribute and a dimension on the other. An object refers to the "thing" that possesses or carries that attribute. For example, it might be a particular color chip. The object itself possesses many attributes: color, size, etc. The term quantity refers to a particular amount or degree of a given attribute possessed by a particular object. This is the stimulus value of the object. In regard to attributes and dimensions, attributes belong to objects and dimensions belong to attributes. An attribute refers to a particular property of an object that is capable of further subdivision such as length and color. Dimensions characterize a particular attribute of which some like length are undimensional and others like color or word meaning are multidimensional. In the present study the stimulus objects are the word-sets expressing logico-semantic relations. While the complex attribute involved has no single name it is concerned with the general domain of the strategies or processes of meaning retrieval. The dimensions obtained will be the dimensions of meaning space

with respect to which individuals vary and by means of which they ascribe meaning to words.

Concept was defined as:

> ... a way of grouping an array of objects or events in terms of those characteristics that distinguish this array from other objects or events in the universe (Brown in Bruner, Goodnow, and Austin, 1962, p. 275).

Word was defined as:

> ... a verbal symbol composed of letters or phonemes and comprising in groups, the vocabulary of an individual ... a word is a symbolization of an object, where object is used broadly to include all concrete objects and abstract concepts used for purposes of communication (Barbe, 1959, p. 20).

Further, words are single unique groupings or sounds or letters which may be subclassified into basic words and derived words according to a definite set of rules.

Idealized Individual was considered to be a hypothetical composite person, mathematically derived. This "person" was the product of the individual differences model for multidimensional scaling, a quantitative system which provides "... for differential representations of perceptual structures for individuals having different viewpoints about stimulus interrelationships (Tucker and Messick, 1963, p. 333). Using this technique, a separate multidimensional representation of the perceived stimulus space is provided for each consistent viewpoint about stimulus similarity.

V. HYPOTHESES

The following general hypothesis was formulated from consideration of the theoretical bases of the study: Children's meaning space will exhibit the influences of learning and developmental factors when measured by the Semantic Features (SF) Test.

The Semantic Features Test was designed to distinguish between the strategies used by children with different semantic abilities. A set of research hypotheses concerning the anticipated effects of the independent variables upon children's strategies of signification or dimensions of meaning follows:

1. Younger children, and those with less language experience, will employ simpler strategies as evidenced by higher loadings on categories of meaning having less complete and complex kinds of meaning. The converse will be true for the more mature and competent individuals.

2. Dimensions of meaning will be less logically coherent for the less mature.

3. The more mature and competent Ss will display a semantic space comprised of fewer, logically more coherent dimensions than will the younger children.

Those hypotheses which were tested by selected statistical procedures were phrased as null hypotheses as follows:

1. There is no significant difference between

grades five and eight in their responses to individual items on the Semantic Features Test when compared with the responses of an adult as indicated by the test means.

2. There is no significant variation in the way the categories of meaning comprising the SF Test are used within the grades.

3. There is no significant difference in the way the categories of meaning comprising the SF Test are used between the grades.

4. There is no significant correlation between use of the categories of meaning and scores on a conventional test of vocabulary for the two treatment groups.

5. There is no significant correlation between use of the categories of meaning and scores on non-verbal tasks for the two treatment groups.

VI. ASSUMPTIONS AND POSTULATES

The basic assumption underlying this study was that the language user employs certain strategies or dimensions of meaning, explainable in terms of verbal mediating responses, in processing sensory data including the symbols making up the language system. These dimensions allow the individual to organize his perceptions and experiences into a class representing a degree of generality over separate presentations of the stimuli. This results in consistent responses to certain classes of stimuli. Such organization of experiences and the responses to it can

be said to constitute the meaning of concepts. Bruner et al. point out that:

> The sequence of decisions made by the person en route to attaining the concept, i.e., en route to the discovery of more or less valid cues, may be regarded as a strategy (Bruner, Goodnow, Austin, 1962, p. 234).

In the behaviorist tradition the concept of dimensions of meaning or strategies of signification is explained in terms of patterns of relationships that can exist among initiating stimuli, mediating responses and stimuli, and terminating responses (Goss, 1955). Of similar origin are Wicken's (in Duncan, 1967) analysis of the strengthening of discriminative responses to values along one dimension of multidimensional stimuli, and his hypotheses as to how verbal mediating responses might be the vehicles of "perceptual sets" (Wickens and Eckstrand, 1954).

The investigator postulated the presence, in the individual's meaning space, of experientially determined dimensions of meaning or strategies of signification such as the following:

1. Definition by class membership
2. Definition by example

VII. LIMITATIONS OF THE STUDY

The following limitations of the study are noted:

1. The experimental population will be limited to Grades Five and Eight children in one geographic are of

the Province of Alberta.

2. Only children attending public school will be the target population; children attending special institutions will not be included.

3. The Semantic Features (SF) Test cannot be compared with other similar measures as none is presently available.

4. The SF Test may not comprise all the ways in which meaning can be ascribed to a concept.

5. The SF Test does not measure the quantity of an individual's vocabulary.

6. The study does not include an examination of the influence of syntax upon meaning but rather examines some aspects of the psychological nature of meanings of words in isolation.

VIII. OVERVIEW OF THE STUDY

The investigation of the dimensions of meaning space of children was conducted in a series of steps. These were:

1. An analysis of research and literature to obtain the categories of meaning responses elicited from children under various conditions of vocabulary measurement as well as other kinds of meaning relationships.

2. The construction of a vocabulary test to deduce the strategies used by children in ascribing meaning to words from the dimensions (the extent or repertoire) of their meaning space.

3. The administration of the test to a small group of grade school children to determine the practicability of the test format and analytical procedures and to provide data for revision of the test.

4. The conducting of a pilot study with children in grades four, five, and six.

5. A final revision of the test.

6. The administration of the SF Test to children in grades five and eight who are attending school in urban, small town, and rural schools in Alberta to investigate their meaning space.

7. Statistical analysis and interpretation of the data.

IX. ORGANIZATION OF THE STUDY

The description of the present study will be developed as follows:

Chapter II will provide the theoretical position upon which the study is designed including both the nature and development of word meaning.

Chapter III will present the review of related literature and research in the field of vocabulary measurement and concept development from the psychological standpoint.

Chapter IV will give the details of the development of the SF Test and report the results of the pilot study.

Chapter V will set out the experimental design for administration of the tests and the analysis of the data.

The results of the experiment will be analyzed

in Chapters VI and VII providing the basis for Chapter VIII, the summary, conclusions, and implications.

CHAPTER II

THEORETICAL POSITION OF THE STUDY

The problem of word meaning is as old as language but until recently has remained largely in the hands of philosophers and logicians. Since the turn of the century, though, psychologists and educators have focused serious attention upon the problem, for both academic and practical reasons. In this respect, the present study was an attempt to look upon meaning as a process occurring within the individual's cognitive functioning as well as an approach to the measurement of this process.

The intimate relation of vocabulary to the thought process has long been recognized:

> ... a person's construction of semantic concepts necessarily involves a number of psychological processes, e.g., perception, symbolization, and abstract thinking. It is also influenced by personal experience, social customs and cultural values (Fischer, 1966, p. 24).

Church, therefore, suggests that:

> ... one comes to terms with reality only through a continuing dialectic in which language plays an intimate and indispensable role, and which orients us schematically to a multidimensional universe infinitely broader and more variegated than anything that can be known perceptually and at first hand (Church, 1963, p. 136).

Word meaning, therefore, has come to be considered the result of the active encounter of thinking individuals with reality where the organism mediates verbal sensory data in order to ascribe meaning to it. Such "interpretative"

behavior by individuals has given rise to verbal mediation theories of meaning and resulted in the development of instruments, such as the Semantic Differential (Osgood et al., 1957), designed to measure the underlying psychological processes. Taking the position that meaning depends upon the relations between symbol and referent, associationists have sought to establish the number and strength of associations between words as measures of meaning (Creelman, 1966, p. 130). In either case it is held that the individual "learns" certain responses. Meaning, therefore, can be considered both a process and a product variable resulting from the organism's behavior in interpreting environmental stimuli.

The mediational view of meaning suggests a relatively unique kind of semantic organization underlying each individual's verbal behavior. For purposes of analysis and discussion this organization might be considered to comprise a multidimensional semantic space which serves to process words for the individual. The quotations from Fischer and Church above allude to this position and Osgood (1957) has used this approach in examining the connotative meanings of words. Schematically (Figure 1) the above position might be illustrated thus:

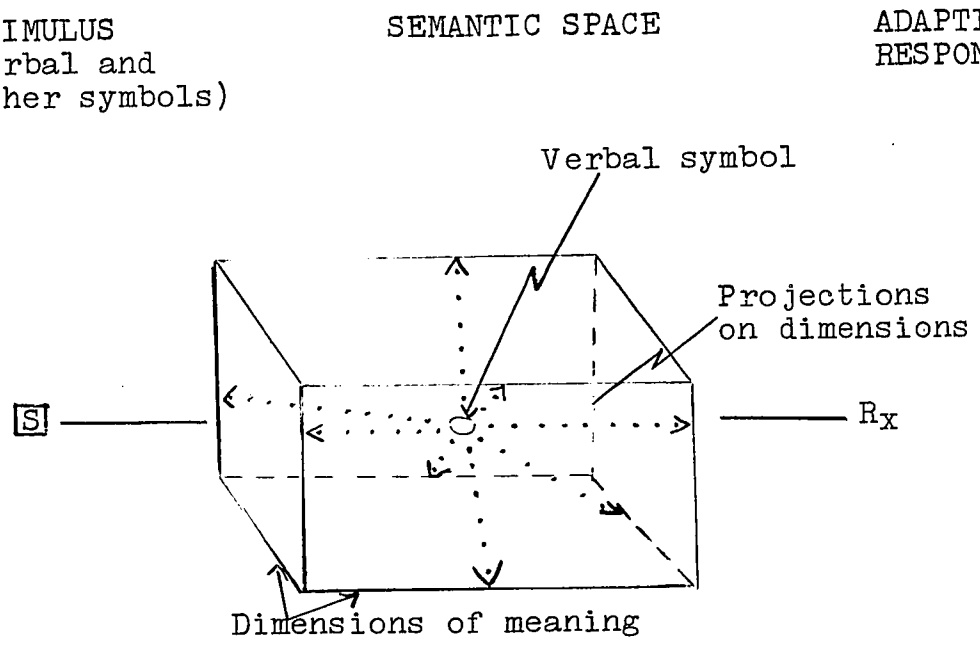


Fig. 1 MODEL OF ASSUMED RELATION OF SEMANTIC SPACE TO VERBAL STIMULI

According to the position taken by the writer, an individual makes adaptive responses (overt or covert) R_X to verbal stimuli on the basis of what these stimuli "mean." Meaning accrues to the symbol when it is placed in the individual's semantic space and, therefore, depends upon the dimensions which constitute this space. The dimensions, comprised of logico-semantic relations, i.e., the way meanings of words can vary (Appendix B), become conditioned behaviors resulting from the individual's learning history. In other words, the individual learns that words can stand for different dimensions of relevance of environmental data, e.g., physical attributes, logical relations, spatial relations, use, etc. Particular words, of course, draw upon only certain dimensions for meaning. The symbol, therefore, when it impinges upon this space,

results in projections upon certain of the dimensions which define the space. The nature of the dimensions is thus a determiner of the quality of the meaning of the concept for which the word is a symbol and consequently a determiner of the meaning of the word. Dimensions of meaning will vary with experience, quality of intellectual functioning, and other meaning-related variables and it is assumed that the lack of certain of these dimensions necessarily denotes an inability on the part of the individual to perceive certain qualities of meaning.

Semantic space, as a hypothetical construct, might, therefore, be defined as an n-dimensional space which identifies and defines the individual's verbal mediating responses and describes the process or strategy applied by this individual in assigning meaning to verbal data. This space may be considered to be Euclidian in nature, possessing a varying number of orthogonal dimensions. These dimensions define the limits of this space and are the kinds of logico-semantic relations the individual can conceptualize as existing between sensory data and linguistic symbols or between linguistic symbols themselves.

It will be noted that the above position suggests an active role for the organism in processing verbal stimuli. Thus it was stated earlier that meaning considered from this perspective is a process variable. The dimensions postulated to define semantic space are the orientations or sets the individual develops in the course of his

verbal learning history. Lynn sees such orientations as introspective attention reactions:

> ... the orientation reaction, including orientation towards the stimulus for the purpose of further investigation. Here it is a learned response and is elicited by stimuli which are familiar but whose meaning is still to some extent uncertain (Lynn, 1966, p. 9).

These dimensions or orienting reactions are fewer in number than the totality of the ways in which words can vary in meaning since the tendency in human psychological behavior is towards the reduction of complexity in interpreting environmental data. In other words, the individual becomes conditioned to look for certain kinds of relationships between words and their significates. This searching or hunting is the process of word meaning retrieval and may be supposed to be enabled by the orienting reaction postulated by both Soviet and American psychologists (Berlyne, 1965). This is essentially the position the present writer adopts in explaining the process of signification, i.e., the manner by which the dimensions of an individual's meaning space determine the qualities of meanings of words and concepts. Perhaps the most succinct and lucid expression of this notion is presented by Zaporozhets:

> Despite all the differences between orienting responses in sensation and in thought, they are united by a similarity of function and a genetic relationship. It can be assumed that the physiological mechanism of inner, covert orienting responses is prepared in the process of external, overt orientation. During an inner, ideational search, a focus of optimal excitation, like the beam of a searchlight, "rummages" through the cerebral

> cortex, seeking and reviving those traces of past experience that have a more or less close relation to the problem being solved by the subject at the present moment. This search has a selective character and is, in accordance with the circumstances, invariably directed into a definite channel, a particular itinerary, by the cues of inner speech. But how is this channel formed, how is this itinerary put together, through which internal, verbally controlled attention moves?
>
> It is evidently put together in the first instance by the process of external, sensory attention, by the process of external overt orienting activity, aimed at the investigation of real, immediately perceived objects and situations. In coming up against their objective properties, the orienting response changes its form by a conditioning process and adopts an itinerary determined by them. And this itinerary, which is "traced out" in the cerebral cortex by movements of the sensory equipment and corresponds to the properties and interrelations of objects that have been inspected, is like-wise followed by the inner search when a subject is concerned not with real objects but with objects that he is representing to himself and thinking about. (Berlyne, 1965, p. 112).

The orientation reaction, long interpreted in physiological terms, has of late been finding a more central role in psychological theory, e.g., theories of personality (Eysenck in Lynn, 1966, p. vii). There is general agreement that through the orienting reaction, the organism alerts itself to deal with the possible eventualities which the incoming stimuli may herald.

> In man this reflex has been greatly developed with far reaching results, being represented in its highest form by inquisitiveness - the parent of that scientific method through which we hope one day to come to true orientation in knowledge of the world around us (Pavlov in Lynn, 1966, p. 1).

Lynn (1966) has classified the components of the orientation reaction into five categories. The purpose of these physiological changes, in general terms, is to

make the organism more sensitive to incoming stimuli. Sokolov (in Brazier, 1960) and Gastaut (in Jasper, 1957) distinguish two varieties of orientation reaction. The generalized orientation reaction is elicited first and involves arousal over the whole cerebral cortex. The localized orientation reaction is confined to the cortical area of the particular sensory modality. These varieties are believed to depend in part upon the state of the subject. Furthermore, these components of the orientation reaction do not necessarily occur in all subjects, there being individual differences. The variations in physiological and neurological orientations were, therefore, considered to result in a different representation of stimuli. This representation would then constitute the meaning of the stimuli.

The orientation reaction involves other responses made to novel stimuli. "Two other [related] responses are possible, namely adaptive and defensive reactions" (Lynn, 1966, p. 6). Adaptive reactions operate to preserve equilibrium, i.e., provide negative feedback while the orientation reaction increases sensitivity to stimulation. Also, the adaptive response does not habituate with repeated stimulation. These characteristics of the adaptive reaction would make the individual note the familiar and recognizable qualities of stimuli to maintain equilibrium in perception of these stimuli. Defensive reactions (startle reactions) involve, in general, physiological reactions which

mobilize the individual for efficient action. These constitute the "primary attention" reaction. "Secondary attention reactions" or introspective attention, is:

> ... the orientation reaction including orientation towards the stimulus for the purpose of further investigation. Here it is a learned response and is elicited by stimuli which are familiar but whose meaning is still to some extent uncertain (Lynn, 1966, p. 9).

For example, a geologist and non-geologist pass by a rock. The non-geologist does not notice it, but the geologist immediately sees and investigates it. Secondary or introspective attention appears to be that component of semantic behavior which orients the individual to certain dimensions of relevance of stimuli learned through experience.

Berlyne (1960) has distinguished seven kinds of situations evoking orientation reactions. These were reduced to three by Lynn (1966, p. 13). The first is novelty - where something is novel about the stimuli. The second involves conflict - where orientation reactions are made to positive and negative stimuli until discrimination becomes perfect. The third type of stimulus involves conditioning. Grastyan (in Brazier, 1961) has shown that the orientation reaction may be best regarded as a conditioned reaction. First, he argues that the orientation reaction only appears after several applications of the stimulus. Second, he states that the orientation reaction can easily be habituated, therefore, it resembles conditioned rather than unconditioned reactions. Third,

the orientation reaction is absent in infancy and emerges only after learning has occurred. The notion that the orienting reaction is a conditioned response has powerful implications for meaning. It suggests that the individual learns new dimensions of relevance of, or ways of orienting himself to, stimuli and that meaning is ascribed to stimuli on the basis of the representations he has of these stimuli.

Vygotsky, Buhler and Gatzer (in Cole and Maltzman (Eds.), 1969, p. 144) contend that language learning begins with an orienting reaction to words but that at first it is not the lexical quality of the word but the simple novel stimulus effect that is the controlling one. They go on to say that gradual discrimination of verbal signals from the remaining components of the situation occurs and the original orientation reaction initiates a conditioned response to words. The child's speech, they conclude, then becomes a means of orienting himself to a new situation and of organizing and mobilizing previous experience.

Ruzskaya (in Cole and Maltzman (Eds.), 1969, p. 147) suggests that the role of words in the discrimination of objects increases as the discrimination becomes more subtle and Martsinovskaya (in Cole and Maltzman (Eds.), 1969, p. 179) contends that the orienting reaction comes to control overt action through the semantic component of words. In the latter instance the individual reacts, not only to the sound stimulus associated with the word producing a generalized response, but with an appropriate

specific response in terms of the meaning, e.g., until a child learns the meaning of "yes" and "no" the uttering of either of these words results in a generalized response similar for both. Zaporozhets (in Cole and Maltzman (Eds.), 1969, p. 184) concludes that capacity for complex activity according to verbal instruction is, therefore, related to change in orientation methods. Thus, the mastery of a word and its use alters the perception of an object. Words and concepts are assimilated according to orientations established toward them so that a child's orienting reactions determine what shall be discriminated in representing stimuli by words. The words the child learns and the orientations or semantic dimensions which direct his learning consequently restructure his sensory cognition of reality, i.e., determine the meaning of concepts for him.

The concept of orienting reactions or dimensions of meaning must also be considered within the context of intellectual development. The "Cumulative Learning Model," Gagne (1968), presents a view of learning and of cognitive development which the writer has accepted as descriptive of acquisition of the verbal behaviors considered in the semantic space model. Gagne expresses this position as follows:

> Intellectual development may be conceived as the building of increasingly complex and interacting structures of learned capabilities. The entities which are learned build upon each other in a cumulative fashion and transfer of learning occurs among them. The structures of capability so developed can interact with each other in patterns of great complexity, and thus generate an ever

> increasing intellectual competence. Each structure may also build upon itself through self-initiated thinking activity (Gagne, 1968, p. 190).

Figure 2 illustrates this notion, i.e., that much of what is learned by the organism takes the form of sets of rules and orienting reactions. These are formed from simpler entities such as concepts. The learning of concepts, in a similar manner, depends upon certain prior discriminations such as those of extent, attribute, and relationship of objects or abstract entities. These in turn require prior learning chains "... particularly those which include verbal mediators. And finally these chains are put together from ... associations or 'S - R connections'" (Gagne, 1968, p. 182). The outcome of this sequence corresponds closely to the orienting reaction notion postulated by Berlyne (1965). Gagne concludes: "... 'rule' refers to what might be called the 'meaning' of ... a statement, and not to its verbal utterance" (Gagne, 1968, p. 182). These rules, ways of perceiving relationships such as synonymity or contrast among concepts or entities are activated and organized by the broader orientations that have been conditioned to environmental stimuli. These orientations may be considered to be the individual's dimensions of meaning.

Relating this model to the concept of semantic space provides one description of the manner in which dimensions of meaning, i.e., orientations or sets are formed from simpler entities such as the various categories of

meaning which in turn result from direct associations between significates and symbols. The model also indicates that those individuals who have not learned certain of these lower-level relationships "... could not acquire a higher-level capability to which it was related" (Gagne, 1968, p. 183).

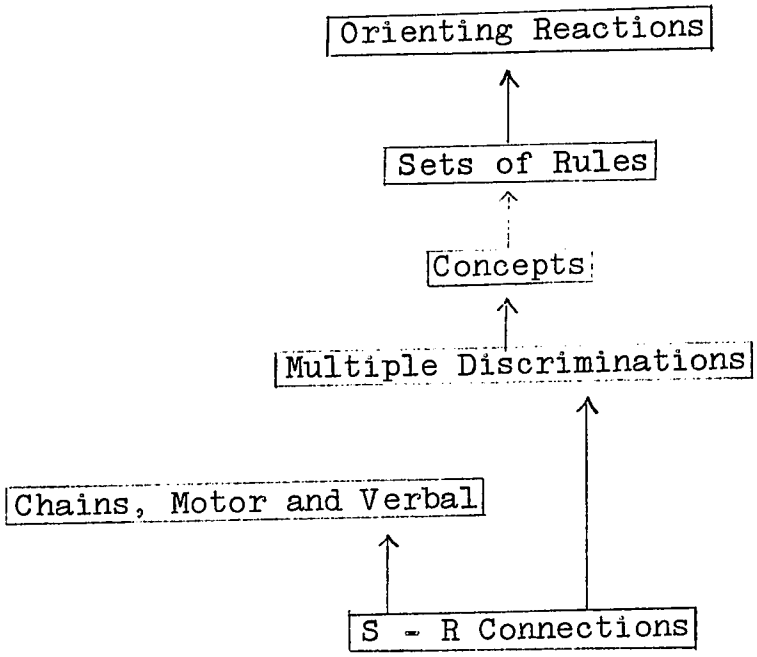


Fig. 2 MODEL OF A GENERAL SEQUENCE FOR CUMULATIVE LEARNING (After Gagne, 1968, p. 182).

This type of cumulative learning provides for transfer or generality because of the occurrence of identical or similar elements (concepts or other learned relationships) within developmental sequences. Consequently, the same orienting reactions can be considered to apply in all instances of verbal behavior.

The "stage" of the learner or the quality of semantic space he possesses can be identified by describing

his present capabilities and the capabilities he must acquire to make possible the ultimate or most adequate combination of subordinate semantic elements into the most productive "rules" and dimensions of meaning. In respect to "stage" theory, Gagne (1968, p. 189) contends, stages of development are not related to age except in the sense that learning occurs in time. Similarly, they are not related to logical structures except in the sense that the organizing of prior relationships into new ones depends upon an inherent logic.

Thus, similar kinds of semantic space may be present regardless of the age of the individual. The ontogenetic effect upon intellectual functioning is not considered to be the sole or major influence in its development. Rather, it is assumed that cumulative learning within the context of maturation results in intellectual as well as linguistic development.

It is to be noted, however, that the intellectual processes described above are inferred by the observer as a result of the behaviors elicited from subjects. They are therefore abstractions postulated by the observer and may not exist in the mind of the learner. The value of such an abstraction lies, however, in its hypothesis testing powers.

Operating upon the basis outlined above, the writer developed an instrument, The Semantic Features Test, designed to identify the dimensions of individuals' meaning space (Appendix A). From these dimensions, one can infer

the kinds of strategies or processes that underly meaning retrieval. The specific details of the construction and operation of the test can be summarized as follows.

The basic model, Figure 3, suggests the nature of meaning responses (categories or discriminations) used in concept formation and word meaning retrieval. This model identifies the function of mediating responses in ascribing meaning to verbal stimuli and constitutes the basis for the measuring technique and the instrument used in this study. These mediating responses correspond to the observing response concept (Kurtz, 1955) and that of the orienting response (Berlyne, 1965) as already noted.

Figure 4 is a model representing the assumed relationship between the process of concept attainment and subsequent identification or signification of words, and the relation of this process of word meaning retrieval to the psychological operation of the Semantic Features Test. The concept attainment process, Figure 4A, as a mediating response, organizes words as sets of initiating stimuli into meaning bearing concepts through the identification of relevant dimensions and their subsequent categorization. When a label has been ascribed to a concept, the word can come to elicit a particular meaningful response, Figure 4B, when the individual's strategies of signification or ways of perceiving meaning are applied at the representational mediation stage. The Semantic Features Test, Figure 4C, was designed to reveal the

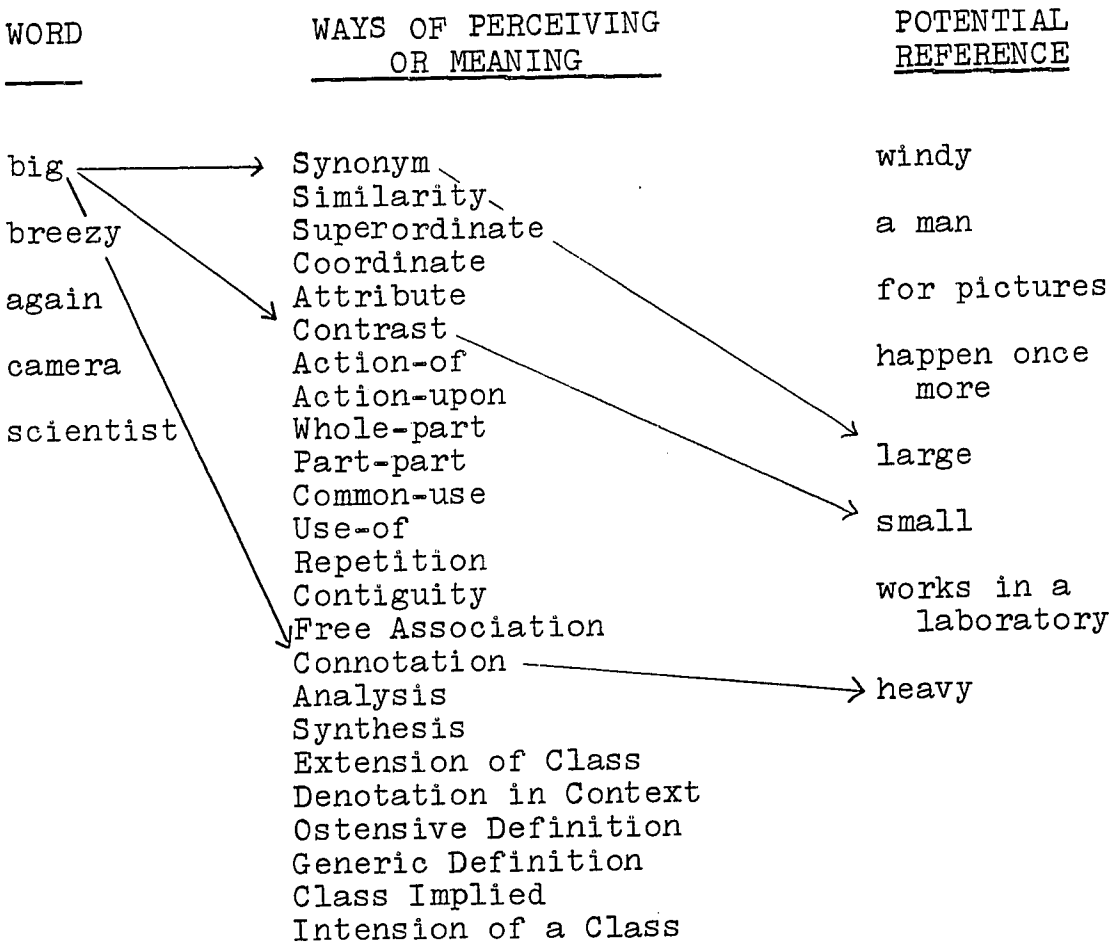
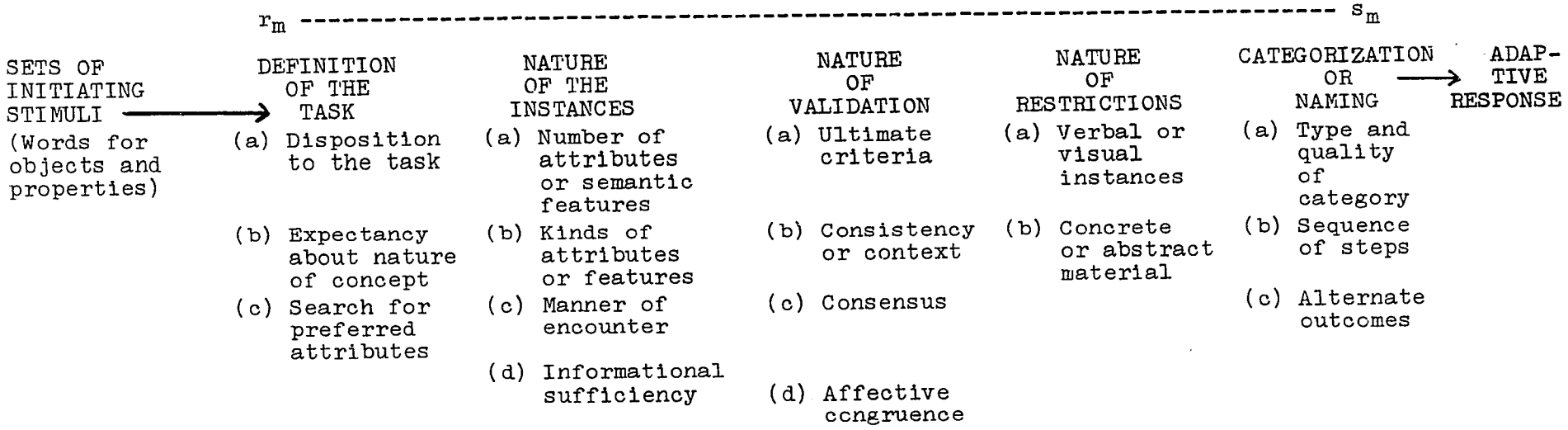
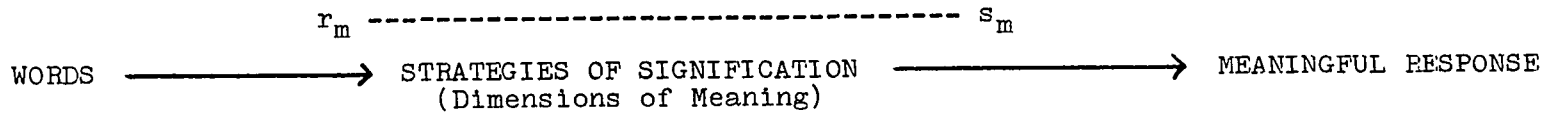


Fig. 3 CATEGORIES OF MEANING RESPONSES
(After Osgood, 1953, p. 631)

A. CONCEPT ATTAINMENT



B. WORD MEANING RETRIEVAL



C. SEMANTIC FEATURES TEST

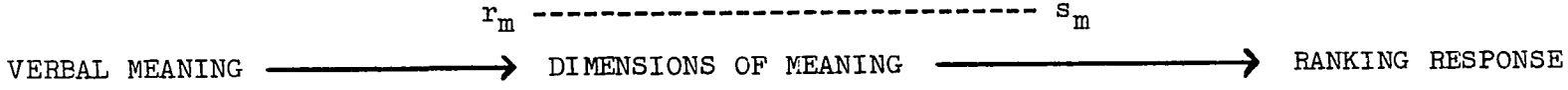


Fig. 4 MODEL OF THE ASSUMED RELATION BETWEEN CONCEPT ATTAINMENT, WORD MEANING RETRIEVAL, AND THE SEMANTIC FEATURES TEST (After Bruner et al., 1962; Osgood et al., 1957).

individual's strategies of signification or dimensions of meaning through his ranking response. Ranking of paired comparisons of semantic relations, it was postulated, would, when analyzed by means of a multidimensional scaling program, reveal the dimensions of children's meaning space and in essence, their "meaning of meaning."

SUMMARY

Word meaning is achieved through a process of locating the verbal symbol in the individual's semantic space. The dimensions of this space develop as a result of the individual's learning history. They constitute orienting responses to words and are comprised of categories of logico-semantic relations between words and significates. The categories of meaning develop, through a process of cumulative learning, a set of rules or responses to verbal stimuli which direct the individual to certain dimensions of relevance of environmental data and constitute the meaning of concepts. Meaning, therefore, is the result of a strategy employed in relating the word to kinds of semantic relations and a function of the cumulative learning history of the language user.

CHAPTER III

REVIEW OF THE LITERATURE

I. LANGUAGE, CONCEPTS, AND MEANING

Language can be described as a system of categories having important relations with the nonlinguistic categories of thought and culture (Brown in Bruner, Goodnow, and Austin, 1962). Utterances become meaningful when they are coordinated with nonlinguistic or referential categories. Razran (1939) and Riess (1946), in related studies on linguistic conditioning, showed that when an utterance becomes meaningful it causes us to take account of something beyond itself. It has always been a central problem of a psychology of language to determine the nature of linguistic reference. Brown (in Bruner, Goodnow, and Austin, 1962, p. 269) suggests that the adult appears to see through the words to their common referent while for the child the words are still opaque. Children and adults, therefore, employ different strategies, embodying "cognitive structures" in abstracting meaning from words.

"Concepts are the cognitive structures that each child must develop in the course of intellectual functioning" (Stauffer, 1969, p. 293). These structures are acquired through thought, being symbolically embodied in signs, i.e., words. These words represent an act of generalization so that the "... relationship between

thought and word is not a symbol - experience "thing" but a process - a process that is undergoing constant change" (Stauffer, 1969, p. 294).

Linguistic symbols are considered to attain a degree of meaning by constant association with their referents. This results in learning and appropriate neurological changes:

> It is my belief that when someone learns to understand an utterance his nervous system is partially "rewired" (in the sense of changes in synaptic resistance or neurone process growth) so that he is disposed to behave appropriately with regard to that utterance ... (Brown in Bruner, Goodnow, and Austin, 1962, p. 275).

The individual's behavior relative to linguistic symbols will thus be determined by his cognitive organization. It was the purpose of the study to examine the nature of this organization.

A concept consists essentially of the perception of relationships among stimuli (Underwood, 1952). Bruner et al. go on to say that: "The working definition of a concept is the network of inferences that are or may be set into play by an act of categorizing" (Bruner, Goodnow, and Austin, 1956, p. 244). They conclude. therefore, that a concept may be regarded as:

> ... a network of sign-significate inferences by which one goes beyond a set of observed criterial properties exhibited by an object or event to the class identity of the object or event in question, and thence to additional inferences about other unobserved properties of the object or event (Bruner, Goodnow, and Austin, 1956, p. 244).

A concept has also been defined as "grouping an

array of objects or events." In word meaning on the denotational level evidence of this grouping is seen when a particular response is elicited by a particular array of objects or events and not elicited by entities outside the array. Thus, a human subject can give evidence that he has attained a concept by correctly using words, i.e., when he is able to use the word in new instances of the concept without further training. In the same way a word is fully understood when it can be extended to entities that one has not heard labelled (Brown in Bruner, Goodnow, and Austin, 1962, p. 275).

> In the learning of language, words ... come to be perceived as distinct entities, and in this sense they form one class of perceptual invariants along with the perceptual invariants that represent common objects, feelings, and events (Carroll, 1964, p. 185).

Words and higher units in the linguistic system come to stand for or represent concepts learned through experience. "For the English language, these categories correspond roughly to proper and common nouns; adjectives; and verbs of action, perception, and feeling" (Carroll, 1964, p. 186). The processes by which words come to mean or "stand for" concepts is based upon some sort of reinforcing condition that associates a word with a given concept. It is these processes that determine word meaning. The conditions under which the use of words is rewarded or not rewarded results in the rules of usage of a word and define that word's denotative meaning, while connotative meaning depends upon aspects of concepts which are emotional and noncriterial in content (Carroll, 1964, p.,186).

In stimulus-response analyses of concept formation, verbal mediating responses are important elements. Hull (1920), Smoke (1932), Heidbreder (1946), Reed (1946), Mandler (1957), and Lacey (in Duncan, 1967) have examined the mechanism of response-mediated similarity and generalization and the complimentary mechanism of response-mediated similarity and discrimination. Kurtz (1955) explains the operation of verbal mediators with the notion of "observing responses" where the individual learns to make appropriate observing responses which transfer to other tasks. This orienting behavior directs the individual's attention to particular dimensions of relevance on the basis of his learning.

Pavlov's "second signalling system" is essentially equivalent to mediating responses and stimuli and this has been the basis for recent analyses of higher nervous activity by Soviet psychologists. Vygotsky, Luria, Zaporozhets, and other Soviet psychologists have postulated the orienting reaction concept operating as part of the second signalling system (Berlyne, 1963). This conditioned behavior increases the organism's sensitivity and information extracting capacity. In fact, for Zaporozhets, this becomes a conscious attentive process. The present study postulated a number of such orienting reactions or dimensions, i.e., ways of perceiving the relevant characteristics of stimuli existing within this process of concept development. These were considered to comprise the individual's meaning space.

Vygotsky et al. (in Cole and Maltzman, 1969, p. 144) contend that language learning begins with an orienting response to words and that gradual discrimination of verbal signals from remaining components of the situation occurs so that the original orienting response (OR) becomes a conditioned response to words. Words then become a means of "orienting" oneself to a new situation, organizing and modifying previous behavior. The OR, thus, becomes a component of the meaning response to a word.

El'konin (in Cole and Maltzman, 1969, p. 190) states that mastery of a word and its use alters the perception of an object. The assimilation of words restructures the sensory cognition of reality. Words, he contends, are assimilated according to orientations established towards them; thus a child's orienting reactions determine what shall be discriminated in representing stimuli by words. Words become conditioned to certain characteristics of stimuli so that meaning is ascribed to these words as symbols.

Because current research indicates that concepts and meaning should be viewed in a broader, more dynamic way than previously, the conventional definitions of concept formation and vocabulary development are not adequate.

> One of the greatest weaknesses is the unfortunate tendency to regard words as concepts rather than to recognize that a verbal response is merely a label for the internal cognitive system, which from the psychological standpoint, is actually the concept (Vinacke, 1952, p. 100).

Consequently, the importance of mapping out these internal cognitive systems rather than merely counting the number of words an individual knows becomes apparent. The present study attempted to examine such cognitive functioning.

In discussing children's concepts and their relation to language Russell contends that:

> The variety of a child's concepts ... is exemplified in his language development. While not all separate words he uses are different concepts, they indicate the variety of understandings he possesses (Russell, 1956, p. 125).

However, a child's understanding vocabulary is always greater than his spoken vocabulary (Smith, 1941). As a result of this situation, measurement of the extent of a child's spoken or written vocabulary is an insufficient index of his understanding vocabulary. A more adequate measure of "meaning" would be the individual's ability to handle new instances of sensory data, i.e., an index of the cognitive organization by which he processes new data. Relatively little success has resulted in such attempts in the past since:

> ... The situations and tasks utilized have typically been very narrow, and the behavior observed has largely been the simple, readily quantifiable response of the subject (Vinacke, 1952, p. 97).

It is important to bear in mind the indirectness of the relations between words and things when considering the meaning of words. Ogden and Richards (1956, p. 11), Figure 5, illustrate this by a diagram in which the three factors involved whenever a word is uttered or understood are placed at the corners of a triangle, the relations

which hold between them being represented by the sides. It is thus seen that the base of the triangle is quite different from the other sides.

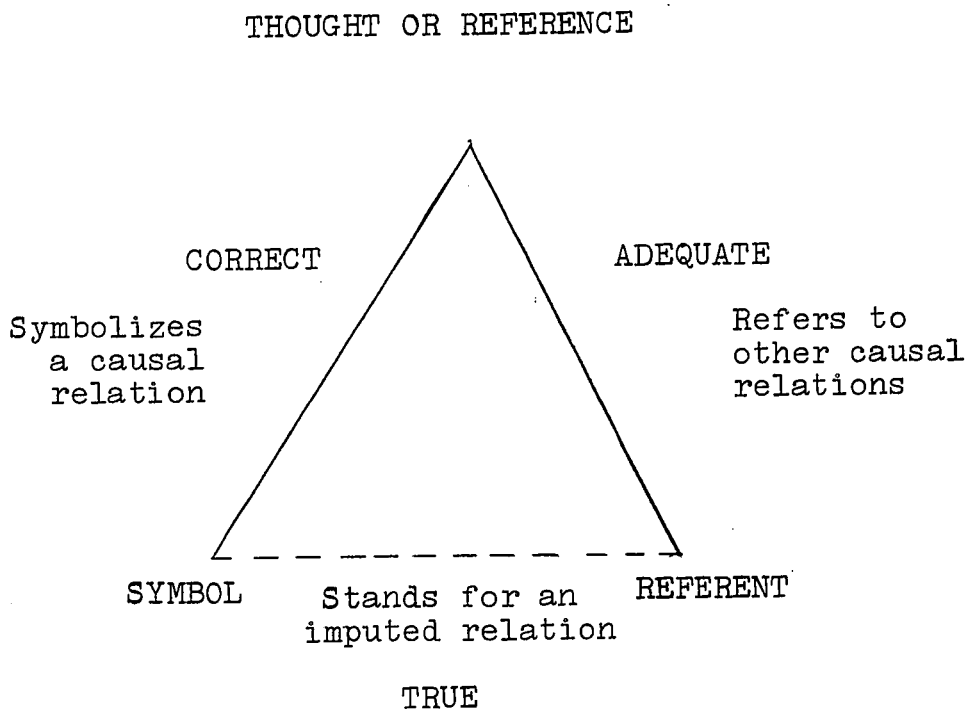


Fig. 5 MODEL OF THE RELATIONS BETWEEN WORDS AND THINGS (Ogden and Richards, 1956, p. 11)

Between a thought and a symbol certain causal relations exist since the symbolism is caused partly by the reference and partly by social and psychological factors. The latter include the purpose for which we are making the reference, the proposed effect of our symbols on other persons and our entire learning history (Ogden and Richards, 1956, pp. 10-11). This perspective upon meaning provides additional theoretical justification for the position taken in the study, i.e., the meaning of symbols is in part a function of the psychological organization of the individual

and the process by which this organization is applied to verbal symbols (strategies of signification).

Between thought and referent a more or less direct relation exists. The relation is direct if one refers to a concrete bit of reality and indirect of the reality is not concrete. At this point, the knowledge one possesses of the things of the world -- both concrete and abstract -- in terms of the relevant characteristics will influence the meaning one has of the referent.

Between the symbol and the referent there is no relevant relation other than the indirect one which consists in its being used by someone to stand for a referent. There is an imputed as opposed to a real relation existing along the two sides of the triangle (Ogden and Richards, 1956, pp. 11-12). This association can be considered to consist of the kinds of semantic relations or categories of meaning the individual has developed in the course of his language learning activities. The categories of meaning identified in this study are presented in Appendix B. The indirectness of this connection has led Salomon to say: "Words don't mean; people mean" (1966, p. 2).

Meaning thus exists in the thought or reference corner of the triangle and as Miller puts it:

> How an utterance is actually manufactured or understood by the users of the language -- what particular cognitive processes he performs -- is not a linguistic problem, but a psychological one (Miller, 1962, p. 748).

Osgood, in the developmental work on the Semantic

Differential, addressed himself to this problem. He concluded that in the measurement of meaning it is:

> ... necessary to focus on that "state of" or "event in" a sign-using organism that is at once a necessary subsequent condition in the decoding of signs and a necessary antecedent condition in the encoding of signs (Osgood, 1957, pp. 320-321).

He further suggests that when a language user comes out with a sequence of linguistic responses which are ordered both as to structural and semantic characteristics, we assume that there is some ordered, selective system operating within the organism. Thus, the student of meaning must determine the correlation between message events and the states and processes within the organism.

The Semantic Features Test used in this study was designed to map out the individual's semantic organization and provide an index of the process operating within that "selective system." This procedure should provide a measure, not of the quantity, but rather of the quality of meaning relations possible for the individual and consequently suggest the kind of cognitive operation of which he is capable. Inherent within this view are both denotative and connotative dimensions of meaning.

Language has enormous implication for the elaboration of conceptual functions since it makes possible an efficient symbolic system and an almost unlimited communication of symbols from one organism to another.

> The development of concepts is first of all an accumulation of experience, with some kind of resulting organization, and secondly the labeling, and manipulation, and application of aspects

> of this organization by means of symbols (Vinacke, 1952, p. 105).

Research has shown that this process takes place in and is shaped by its social, cultural, and educational context as well as being influenced by other variables such as age and experience. These factors appear to produce differential results in the individual in terms of the way he relates symbols to concepts. Such influences were also investigated in this study. Data collected for the sample included information on student intelligence, place of residence, sex, socio-economic status, and age. These data were used in the analysis of the characteristics of idealized individuals to determine the relationship of these environmental and personal variables to verbal competence.

II. CONCEPT DEVELOPMENT

The research in children's concept development has been summarized by numerous scholars in the field of child psychology such as Thompson (1952), Curti (1950), Jersild (1947), Johnson (1955), Russell (1956), and Vinacke (1952). Vinacke (1952, p. 100) has indicated that concepts, their development and meaning, should be viewed in a broader, more dynamic way than has heretofore been the case. He has gone on to summarize the general characteristics of concepts:

> 1. Concepts are not direct sensory data but something resulting from the elaboration,

> combination, etc., thereof ...
> 2. A corollary of the first property thereof is that concepts depend upon the previous experience of the organism.
> 3. Concepts are systems within the mental organization which tie together or link or combine discrete sensory experience.
> 4. It may be inferred that such ties or links are symbolic in nature; that is the same concept may be invoked by a variety of stimuli. In the human organism words usually fulfill this symbolic function ...
> 5. On the side of internal processes of the organism, concepts represent selective factors. An external stimulus response, on the one hand, or a symbolic response guides perceptual activity, whichever comes first.
> 6. Concepts ... have both "extensional" or denotative, and "intensional", or connotative meanings. The extensional meaning ... "is that which words stand for" (Hayakawa, 1941, p. 61). The intensional meaning is ... "that which is suggested (connoted) inside one's head" (Hayakawa, 1941, p. 61).
> 7. Concepts vary in the "consistency" or correctness of their organization as revealed in the experiment of Reed (1946).
> 8. Concepts have both "horizontal" and "vertical" organization. This property has been outlined by Welch (1940). The same object, or relation, has different points of reference, depending upon the other objects with which it is compared (Vinacke, 1952, pp. 100-103).

Studies of concept formation indicate that the steps involved are successive decisions and constitute a strategy. A strategy, according to Bruner et al., refers to:

> ... a pattern of decisions in the acquisition, retention, and utilization of information that serves to meet certain objectives, i.e., to insure certain forms of outcome and to insure against certain others (Bruner, Goodnow, and Austin, 1956, p. 54).

This act of concept formation might be reduced to the following:

> 1. There is an array of instances to be tested and from this testing is to come the attainment

> of the concept. The instances can be characterized in terms of their attributes, e.g., color ....
> 2. With each instance, or at least most of them once the task is underway, a person makes a tentative prediction or decision ....
> 3. Any given decision will be found to be correct, incorrect, or varyingly indeterminate; ... we refer to this as validation of a decision, ...
> 4. Each decision-and-test may be regarded as providing potential information by limiting the number of attributes and attribute values that can be considered ....
> 5. The sequence of decisions made by the person en route to attaining the concept, i.e., en route to the discovery of more or less valid cues, may be regarded as a strategy embodying certain objectives ....
> 6. Any decision about the nature of an instance may be regarded as having consequences for the decision-maker ... (Bruner, Goodnow, and Austin, 1956, pp. 233-234).

Efforts to explain and measure the processes whereby concepts are attained must take account of these characteristics noting particularly the role of language in concept development. The development of concepts is considered to exhibit trend characteristics, i.e., moving from a less to a more complex organization. These were, therefore, considered in the present study of concept attainment.

Developmental trends appear in the concepts of maturing children. Curti has distinguished a four stage progression in the child's conceptual growth:

> 1. The presymbolic stage: The child has learned to react in a characteristic way to a particular [present] object and perhaps apply a name to it.
> 2. Stage of preverbal symbolic behavior: The child may have an idea of a specific absent object. There is no generalization.
> 3. Implicit general ideas: Genuine concepts are taking form and abstraction may be distinguished. The generalization is vague ....

> 4. The stage of implicit generalization: This stage marks the final attainment of true concepts as a gradual development from earlier stages. The child ... has the ability to formulate the meaning of an object in words (Curti, 1950, p. 160).

Curti suggests here that there are no complete and final concepts. Concepts are growing sets of ideas influenced by conditions of the child's life.

Buhler (1930) distinguished four age-bound types of concepts. The first type develops as the child learns the commonest words of the language. The second comes in the use of more general categories. The third type involves the growth of causality. At the fourth stage the child has some concept of order and genus-species.

The theories of Curti and Buhler stress the role of perception in concept development. Welch and Long, in their writings, (1940, 1942) stress classifying relationships. They contend that concepts organize themselves into hierarchies of relationships and the child not only learns concepts applying to one class of objects, but also learns that one class may include other classes.

In general, Welch and Long (1940, 1942) contend that concepts may develop early but that the child cannot verbalize about the genus-species relationship for some time after he first understands it. They also hold that children's conceptual activity develops from simple to complex levels and concepts organize themselves into hierarchies of levels.

These views powerfully suggest the need for vocabulary testing from the perspective of the cognitive processes involved in manipulating sensory data rather than determining whether a child "knows" certain "labels."

Two comprehensive theories of mental development of children are those of Piaget and Werner. Flavell (1963) and Hunt (1961) have described Piaget's notions of cognitive functioning. Their discussion will be used in considering Piaget's views on concept development. Piaget contends that we do not inherit cognitive structures but a way of transacting cognitive business with our environment. This biological endowment, he adds, has two major defining characteristics which are invariant over our whole developmental span: organization and adaptation. Flavell (1963, p. 43) says, "All living matter adapts to its environment and possesses organizational properties which make the adaptation possible." Organization and adaptation are complementary processes in which the cognitive organization presupposes some kind of interpretation of external reality, and adaptation is an assimilation of that something to some kind of meaning system. Thus, as Flavell (1963, p. 50) says: "... the organism can assimilate only those things which past assimilations have prepared it to assimilate" since the primary function of assimilation is to make the "unfamiliar familiar." In this way, cognitive structures are not only generalized to new objects or events but are also

differentiated as a consequence of their own particular attribute demands.

Hunt (1961, p. 112) says that Piaget takes the view that: "... the organism always acts in terms of the centrally organized, Gestalt-like structures which it has present .... Moreover, these structures ... are observed as repeatable and generalizable pieces of behavior termed schemata ...." He also points out that the ready-made reflexive schemata of the infant (such as the schema of sucking) become progressively transformed into the logical organizations of adult life. The picture of the development of cognitive functioning, according to Piaget, is one of continuous tranformations in the organizations or structures of intelligence.

Piaget accepts the crucial importance of experience but only to the extent that a person "... comes to firm grips with reality patterns and profits by the encounter ..." (Flavell, 1963, p. 69). In addition, he argues that it is the nature of the subject's activity that will determine how and to what degree he comes to grips with experiences and uses them to modify future behavior. He also believes that the organism actually constructs his world by assimilating it to some schematic whole which gives it meaning, i.e., he objectifies reality by exploring its relationships, tracing out its attributes and constructing concepts (Stauffer, 1969, p. 315).

It is Piaget's belief that the development and

internalization of cognitive actions proceeds through a series of discriminable stages where there is continuous transformation in the organization or structure of this cognitive functioning. Piaget uses the term "period" to designate "major developmental epochs" in a child's development. The two periods of greatest concern for this study are: the concrete operations period (two years to eleven or twelve years), and the period of formal operations (beginning at eleven or twelve years). Flavell (1963) describes the concrete-operational child as a sober, bookkeeper type organizer of the real. At the same time he distrusts the subtle, the elusive, and the hypothetical. The formal operational child is at once orderly and organized and also daring and uninhibited. His daring and sophistication though, are controlled and planned, and reflect careful analysis of and accommodation to detail.

Piaget's views are powerfully supportive of the experimenter's position regarding the development of strategies of processing environmental and linguistic stimuli to ascribe meaning to them. The notion of the progressive development of the processes of assimilation and accommodation to ever more logical levels of functioning corresponds to the experimenter's views upon the cumulative growth of dimensions of meaning. These dimensions, which enable the individual to process perceptions and ideas, are considered to develop by

becoming more logical and efficient as a result of action and experience. Similarly, the notion of schemata corresponds to the orienting reflex or the dimensions of meaning concepts postulated by the writer which state that the individual reacts to stimuli on the basis of certain learned orientations towards them. Finally the notion that the individual constructs reality or ascribes meaning to concepts is present in both views. Piaget's descriptions of behaviors appropriate to certain periods provide guidelines for interpreting samples of the behavior of subjects.

Werner also submits a theory based on developmental levels. In regard to this position Werner and Kaplan state:

> The stage of maturity characterizing an individual or a group must not be conceived statically, as a fixed pattern of operation; it should rather be understood dynamically, as a potential range of genetically graded functions. Mental growth is definable in terms of reorganization due to inclusion of new forms of operations. This implies that an individual, depending on outer or inner circumstances, may operate at genetically differing levels (Werner and Kaplan, 1948, p. 557).

Ausubel has focused attention on developmental changes in the acquisition and organization of knowledge that affect learning and retention of verbal material:

> (1) As children increase in age, they tend to perceive the stimulus world more in general, abstract, and categorical terms and less in tangible, timebound and particularized contexts.
> (2) They demonstrate increasing ability to comprehend and manipulate abstract verbal symbols and relationships ...
> (3) They are better able to understand ideational relationships without the benefit of direct tangible experience ...

> (4) They tend more to infer the properties of objects from their class membership rather than from the direct experience of proximate, sensory data.
> (5) They tend more to use remote and abstract than immediate and concrete criterial attribute in classifying phenomena, and to use abstract symbols rather than concrete imagery to represent emerging concepts.
> (6) They acquire an ever increasing repertoire of more inclusive and higher-order abstractions (Ausubel, 1963, p. 111).

The evidence from literature and research, thus, indicates that the maturing child interprets his sensory experiences in increasingly complex ways and that his use and understanding of language in some degree mirror this cognitive development. It can also be seen that neither the complexity of the child's concepts nor his ability to select and integrate data to ascribe meaning to words standing for concepts can be adequately measured by existing tests of meaning. Consequently, attempts must be made to obtain indices of the process used by the child in ascribing meaning to concepts rather than merely quantifying the product of this behavior.

III. FACTORS AFFECTING CONCEPT AND VOCABULARY DEVELOPMENT

The previous sections indicated some of the factors present in concept development. It was suggested that the processes by which concepts and word meanings develop are common to children but that extent of this development varies with individuals. These variations are due to factors affecting the development of concepts and meanings.

Gagne (1968, p. 178) states the matter as follows: "Within limitations imposed by growth, behavioral development results from the cumulative effects of learning." He contends that learning contributes to the intellectual development of the individual because it is cumulative in its effects since the child progresses from one point to the next in his development. The child learns an:

> ... ordered set of capabilities which build upon each other in progressive fashion through the processes of differentiation, recall, and transfer of learning (Gagne, 1968, p. 181).

This theory, which is of recent origin, was accepted by the writer as describing the development of semantic competence and served as the basis for interpretation of the data.

Considering the development of concepts and meanings from a more traditional standpoint Vinacke (1951) has summarized the determining factors as: age, intelligence, training and experience, socio-economic status, and vocabulary, i.e., words used. These factors have an evident relationship with the notion of cumulative learning as postulated by Gagne above. Since it was, in part, the purpose of this study to investigate the factors influencing concept development and semantic competence, the factors specified by Vinacke were considered in the findings. In addition to the notions expressed by Vinacke numerous other researchers have provided information about concept development.

Feifel and Lorge (1950) have indicated changes with

age on the vocabulary test of the Stanford-Binet intelligence test. The responses of 900 children showed a preponderance of definition by use and description at ages six and seven, followed by a marked increase in use of synonyms and demonstration by ages nine and ten, and a slight increase in the use of synonyms plus explanation up through age eleven. A move from concrete to symbolic thinking was noted. Similar results were obtained by Burns (1960) and Annett (1959).

In regard to the relation between concepts and intelligence, there is a general lack of agreement among researchers. Some investigators including Welch and Long (1940) believe that mental age may have less influence on concept formation than does chronological age, a view in keeping with Gagne's position. Other investigators find correlations as high as .80 between certain vocabulary scores and mental age (Terman and Merrill, 1937; Spache, 1943).

Concerning the effect of experience upon concepts, a number of researchers show that language deprivation which children undergo in certain social environments results in concept deficiencies. Bernstein's work among the lower classes showed that the language of these children was limited in syntax and vocabulary (Bernstein, 1961). Jensen (in DeCecco, 1967) contends that environmental stimuli, both verbal and nonverbal, ramify the individual's verbal networks and that these networks are

important in mediating problem solving behavior. Consequently, substandard deprived environmental conditions inhibit adequate concept development. Figurel (in Russell, 1954, p. 345) found qualitative differences between the vocabularies of children from slum areas and privileged communities. Underprivileged children knew proportionately more name words and fewer polysyllabic words than those living in privileged areas. John, in her preliminary study of middle and lower class Negro children, concluded that:

> Whatever their genesis, consistent class differences in language skills have been shown to emerge between groups of children from the same subculture but of different socio-economic class (John, 1963, p. 82).

Several studies have identified sex as one of the factors affecting concept development (Russell, 1954, p. 345). These studies generally show the early superiority of girls as a group over boys in vocabulary and word fluency. This is later balanced by boys' higher scores on general information tests. Also, knowledge of concepts becomes more specialized as children mature. Harrell (1957), however, stated that his study "found no tendency for girls to excel boys."

The factors noted above were examined in this study.

IV. MEASUREMENT OF VOCABULARY

> ... a person's construction of semantic concepts necessarily involves a number of psychological processes, e.g., perception, symbolization,

> and abstract thinking. It is also influenced by personal experience, social customs and cultural values (Fischer, 1966, p. 24).

The intimate relation of vocabulary with the thought processes of the individual has long been recognized. Terman (1912) stated that a qualitative analysis of the verbatim definitions of children of different ages and abilities would be of great value. Denis (1943) reviewed studies of language development and of "the content of children's minds," including publications dated as early as 1861. Gansl (1939) pointed out that vocabulary testing has grown up through the statistical approaches of Spearman, Kelly, Thurstone, and others, the first concern of test makers being the size of a person's meaning vocabulary. Probably the best known of these early attempts was Terman's 1916 revision of the Binet-Simon scales. As is evident from the preceding review of literature, this purely quantitative measure of verbal performance is an inadequate measure of the individual's behavior relative to linguistic phenomena.

Kelly (1932, pp. 102-105) analyzed standardized vocabulary and reading tests and found twenty-six different devices for measuring knowledge of word meanings. Using Dolch's classification system he described these as follows:

I. Unaided recall (group or individual testing)
   - A. Checking for familiarity
   - B. Using words in a sentence
   - C. Explaining meaning and defining
   - D. Giving a synonym
   - E. Giving an opposite

II. Aided recall
  A. Recall aided by recognition
    1. Matching test
    2. Classification test
    3. Multiple choice test
      a. Choosing the opposite
      b. Choosing the best synonym
      c. Choosing the best definition
      d. Choosing the best use in sentences
    4. Same-opposite test
    5. Same-opposite-neither test
    6. Same-different test
  B. Recall aided by association
    1. Completion test
    2. Analogy test
  C. Recall aided by recognition and association
    1. Multiple-choice completion test
    2. Multiple-choice substitution test

Kelly concluded that there was no one best technique for measuring word meaning knowledge and that these instruments could not accurately determine the extent or quality of an individual's vocabulary.

The above listing suggests that vocabulary tests differ in their ability to measure concepts as defined in this study. Vocabulary tests which require definition and knowledge of relationships such as opposites and analogies are probably fairly close measures of knowledge of concepts (Russell, 1956, p. 124). The usual multiple choice test of selecting the best synonym from a group of three or four provides only a superficial index of the child's quantitative knowledge of concepts. Cronbach (1942) and Russell (1954) have indicated further developments in vocabulary testing which will provide a closer approximation of the individual's knowledge of concepts.

> When vocabulary tests develop more as tests of depth, breadth, precision, and application, they

> should come closer to being tests of concepts understood by the child (Russell, 1956, p. 124).

Similarly, when vocabulary tests are designed to reveal the processes or strategies by which an individual organizes linguistic data into meaningful concepts, i.e., ascribes meaning to words serving as labels for concepts, they should provide a valuable measure of conceptualizing ability as well as being potential diagnostic instruments.

The development of vocabulary testing has been influenced by the word lists available (Russell, 1954, p. 321). All vocabulary tests are dependent upon predictions from small samples, thus, extreme care must be taken in selecting words for a test. Wesman and Seashore (1949) and Higa (1963) have reported that complexity or difficulty of a word and rarity of a word as given on frequency lists do not necessarily agree. A commonly accepted fact, verified by Lorge (1949), is that the commonest words are multimeaning in character.

Problems in vocabulary testing may be divided into two main categories: (1) mechanical and statistical problems, and (2) problems arising out of the nature of the English meaning vocabulary itself (Russell, 1954, p. 324).

The problems in the first category have been considered, in varying degrees, in many books and papers on psychological testing. These are problems common to all test construction.

The problems in the second category are related to the dual role of language in vocabulary measurement. Language here is both a research instrument and the behavior being investigated. The problems are exemplified in the individual's tendency towards unthinking verbalization "... the manipulation of words without real understanding of them" (Russell, 1954, p. 325). Concepts are symbolized and the symbols standing for these ideas are words. The child may use a word, phrase, or statement of a concept without much understanding of its varied meanings. The quality of understanding should be evident if one could determine the child's ability to process verbal stimuli, i.e., determine the dimensions of meaning used by the individual in ascribing meaning to words. The task of developing a measure of the child's ability to process words was the purpose of the present study.

"The behavior required in reacting to or utilizing words must be reflected as accurately as possible in test situations" (Russell, 1954, p. 326). Wesman and Seashore (1949) suggest two main types of measurement are needed: (1) testing knowledge of word meanings -- synonyms, subtle differences, semantic variations, fluency -- and (2) testing ability to manipulate verbal concepts -- using analogies, syllogisms, classification. The second type of measurement was used in the present study in the form of a semantic features test requiring ranking of meanings. This view raises the question of how closely vocabulary is

related to verbal abilities.

The problem of the nature of verbal abilities has been resolved in some measure by a number of factor studies. Thurstone (1938, 1941) postulated a "verbal comprehension factor" (V) and a "word fluency factor" (W). Some of the abilities he discussed such as perception, may also be related to verbal abilities.

Carroll (1941), in a definitive work, identified nine factors which he interpreted as being components of the general area of verbal abilities. The ones most pertinent to this study are: Factor J, a reasoning factor, possibly one component of the Thurstone's Verbal Comprehension factor; Factor H, a naming factor, involving the readiness or facility in attaching appropriate names or symbols to stimuli; Factor B, a memory factor similar to Thurstone's rote learning ability factor.

Stecklein (1953) obtained a four factor representation of the ten word fluency and vocabulary tests used in his study. These factors further define verbal ability. He interprets the factors as follows:

> Factor a - a word fluency factor, comparable to Thurstone's W factor; Factor b - a vocabulary factor, representing the ability to deal with ideas and meanings of words, similar to Thurstone's V factor; Factor c - a verbal versatility factor, representing the ability to express a given idea by means of several different words or combinations of words ...; Factor d - an ideational fluency factor, a facility in expressing ideas by the use of words and their meanings ....

The present study was an attempt to go beyond the identification of a verbal ability factor to the actual

designing and use of an instrument to index the process underlying the vocabulary or meaning factor. The writer postulated the presence in the individual of a unique strategy for the processing of linguistic stimuli depending upon certain factors affecting concept attainment. It was these strategies that the study sought to uncover as well as their relation to other factors in verbal behavior.

Among researchers concerned with examining conceptual behavior, Feifel and Lorge (1950) set themselves the task of examining the relation of vocabulary to the thought processes of individuals. Their study was concerned with identifying successive stages in concept formation through a qualitative analysis of responses to the Form L Vocabulary Test of the Revised Stanford-Binet Scale. Analysis of the responses showed that younger children significantly more often employed the use and description, illustration, and repetition types of responses whereas older children significantly more often used the synonym and explanation type of response. Also, younger children perceived words as concrete ideas and emphasized their particular qualities whereas older children stressed abstract or class features of word meanings.

Burns (1960) attempted to show that individuals at various levels depart more or less from the general characteristics of an adequate definition which is that it should state the class to which an object belongs and

the features that distinguish it from other objects in the class. He found that children's definitions cannot easily be grouped into logical classificatory categories and that the categories obtained had to be assessed on the basis of psychological as well as logical criteria. He discovered a number of categories of meaning such as definition by emotional tone (connotation), definition in context, definition where class concept is implied, and generic definitions, with various levels within these categories. He concluded that the category indicates the extent to which the definition may be logically adequate and the extent to which it reflects maturity of understanding.

Annett (1959) through a sorting and explanation procedure, examined the dispositional views of conceptual thinking on the assumption that concepts show themselves in dispositions to behave appropriately to recurring features of the environment and that these concepts are acquired gradually through experience. Five methods of explanations of concepts were distinguished, only two of which are recognized in logic. The methods were: no explanation, enumeration of characteristics, physical contiguity, similarity, and class name statements. All but the first and last involve facts about the concepts. The order of development is through no explanation, enumeration, contiguity, similarity, and finally class name suggesting that children first need to analyze the

characteristics of individual objects and concepts and then to consider how these are organized in relation to each other before they can attend to similarities and class membership (Annett, 1959, p. 235).

These latter investigations formed the basis upon which the present study and the Semantic Features Test were designed. The identification of developmental stages in concept attainment and the presence of relatively unique processes of ascribing meaning to words led to the postulating of differential "semantic spaces" for children at different levels as a result of development and learning history. The nature of explanations elicited from individuals in these studies provided the source for the logico-semantic categories making up the SF Test. These categories, it was postulated, would become the elements of a smaller number of dimensions which define the individual's "meaning space."

V. SUMMARY

This chapter examined certain aspects of the evidence concerning concepts, meaning and the measurement of meaning to provide support for the position taken by the investigator.

First, was presented a survey of current views upon the nature of concepts within the language and the notion of meaning as a response mediated by learned behaviors. It was shown that words in language come to

"stand for" nonlinguistic or referential categories of environmental events whereupon they attain meaning through a process of conditioning. Concepts, therefore, are identified and named by words learned through experience. The individual learns to make appropriate orienting responses to these words on the basis of the particular conditioned behaviors established within his language system. These orienting or mediated responses constitute the meaning of words and comprise the dimensions of an individual's meaning space. The dimensions of meaning, therefore, consist of the ways in which a verbal symbol may be related to its referent. A word is merely a label for an internal cognitive organization, being indirectly connected to the referent through the thought processes of the individual. Thus, the meaning of words was considered to be the psychological process of associating the verbal stimulus with the kinds of cognitive organizations (dimensions of meaning) present in the individual.

Second, the development of concepts was discussed. Concepts are considered to be systems of mental organization which combine sensory experience through a symbolic process. The role of language is therefore considered crucial in concept development. One view maintains that concepts develop through a series of stages moving from simple to complex levels. A second position is that the individual learns to manipulate more

abstract symbols and relationships as he matures without proceeding through discrete stages. Thus, the maturing individual interprets his sensory experiences in increasingly complex ways. His use and understanding of language reflect this cognitive development. Measures of verbal ability currently employed are not able to determine the complexity of a child's concepts nor his ability to select and integrate sensory data to ascribe meaning to words. Indices of the process of ascribing meaning to concepts rather than the presence or absence of a label for the concept (the product) would be of value to determining the individual's verbal and conceptual competence.

Third, factors affecting concept and vocabulary development were examined. Several influences upon the formation of concepts were identified. Learning was considered to produce intellectual development. Within the limitations imposed by growth and environmental factors, development of concepts was seen to result from the cumulative effects of learning. The determining factors influencing learning of concepts were then identified as: age, intelligence, training and experience, socio-economic status, and the vocabulary, i.e., the words used. These factors became variables for analysis in the study.

Fourth, the state of vocabulary measurement was considered. At least twenty-six devices for measuring knowledge of word meanings have been identified although no one technique is considered adequate. Vocabulary tests

differ in their ability to measure concepts and cognitive functioning, most being simply a superficial quantitative index of the child's vocabulary. Vocabulary tests face problems common to all tests as well as those specific to measurement of language abilities. The latter problem concerns the dual role of language, i.e., it is both a research instrument and the behavior being investigated. A testing procedure whereby the processes involved in the development and use of concepts could be examined should provide a more useful index of the child's conceptual ability.

Factor analytic studies of the nature of verbal abilities have identified several elements in an individual's language functioning. Other researchers have examined the nature of conceptual behavior identifying certain developmental characteristics of this behavior. The present study was concerned with the development of an instrument to index the process underlying the reasoning or naming (vocabulary) factor identified in these studies. The presence of unique strategies for processing linguistic stimuli was postulated to exist within the individual. This strategy arises as a result of dimensions of meaning forming the individual's meaning space. The Semantic Features Test provides a measure of this behavior from which could be inferred the level and adequacy of conceptual functioning of which the individual was capable.

CHAPTER IV

I. THE CONSTRUCTION OF THE TEST

A test of verbal ability was constructed upon certain premises concerning word meaning and on the individual's verbal behavior as described in Chapters II and III.

The Semantic Features Test consists of 276 pairs of statements comprising twenty-four categories of logico-semantic relations. These are explicated in the following section. Each category was paired once with each other category producing a paired-comparisons type of instrument. The first draft of the test used in the first pilot study consisted of 300 items comprising twenty-five categories of semantic relations. The second draft of the test used in the second pilot study and the final draft used in the major study both consisted of 276 items in twenty-four categories as mentioned previously (see Appendix A).

This chapter will discuss the development of the Semantic Features Test and the pilot study.

II. THE DEVELOPMENT AND ORGANIZATION OF THE SEMANTIC FEATURES TEST

A paired comparisons test format was selected since it permits the individual to make, what are to him, the most suitable responses without being limited by the knowledge that there is a predetermined "correct" answer. Also, the decisions made in each item require a relatively

straightforward discrimination rather than involving much complex reasoning. This minimizes the error which may be introduced into the final results. Thurstone's Law of Comparative Judgement is assumed to explain this process of responding to the stimuli represented by a paired comparisons item (Nunnally, 1967, pp. 51-55).

Thurstone's law is a set of equations relating the proportion of times any stimulus k is judged greater than stimulus j and the discriminal dispersions of the stimuli on the psychological continuum. The format of test items permits the identification of unique response patterns, a result not possible with multiple choice or other similar test formats. There is also less investigator bias in interpreting the individual's behavior in the test situation. It is the subject himself who identifies stimulus relationships rather than the experimenter inferring these associations from the subject's choice of answers. This results in a more reliable index of psychological functioning.

The most important factor in the development and construction of the test was the identification of the categories of meaning used in the test items. A review of research revealed that school children employ a limited number of ways of defining words and that these ways show qualitative change (Annett, 1959; Berlyne et al., 1963; Burns, 1960; Cronbach, 1943; Curti, 1950; Dale et al., 1960; Feifel and Lorge, 1950; Flavell and Flavell, 1959;

Lewinski, 1948; Petty et al., 1968; Russell, 1954; Vinacke, 1951; and Welch, 1940). These scholars have indicated, in general, that concepts develop from simple to complex as the individual interacts with his environment in the process of maturation. He learns to manipulate more abstract symbols and relationships. The way in which the individual knows and defines words or concepts follows his ability at concept attainment. His definitions move from statements about simple characteristics and relationships to complex notions of identity and class membership. A survey of these findings produced twenty-five discrete kinds of logico-semantic relations exhibited in children's word definitions. Subsequent validation procedures and results of the pilot studies reduced this number to twenty-four. The semantic relations present in the categories are the ways in which the meaning of words can vary, i.e., the kinds of relations between symbol and significate. The twenty-four categories of meaning were as follows:

1. Synonym. The members of each word pair have exactly or very nearly the same referent:

   e.g. big - large
   steal - rob

2. Similarity. The members of each word pair are similar through being aligned on some dimension, with the referent of the right-hand member occupying a more extreme position on this dimension:

   e.g. small - tiny
   hungry - starving

3. Superordinate. The left-hand member denotes a common class of which the right-hand concept is a member:

e.g. bird - sparrow
fruit - apple

4. Coordinate. The members of each pair refer to familiar members of a familiar class:

e.g. chair - table
beets - peas

5. Attribute. The right-hand member of each pair refers to a quality or attribute generally recognized as characterizing the object denoted by the left-hand member:

e.g. lemon - sour
turtle - slow

6. Contrast. The members of each word pair refer to opposite ends of a continuum:

e.g. hard - easy
loud - soft

7. Action-of. The right-hand member of each pair is an intransitive verb denoting concrete action associated with and performed by the agent referred to by the left-hand member:

e.g. dog - bark
baby - cry

8. Action-upon. The left-hand member of each pair is a transitive verb denoting a concrete action associated with and performed upon the object referred to by the right-hand member:

e.g. sweep - floor
throw - ball

9. Whole-part. The right-hand member of each pair refers to a familiar object recognized as an important part of a familiar whole denoted by the left-hand member:

e.g. bird - wing
hand - finger

10. Part-part. The members of each pair refer to familiar objects which are parts of a familiar whole:

e.g. wall - floor
arm - head

11. Common use. The right-hand member of each pair denotes an object associated with and acted upon by the agent referred to by the left-hand member:

    e.g. farmer - tractor
    dog - bone

12. Use of. The right-hand member of each unit denotes a use made of the left-hand member:

    e.g. orange - for eating
    envelope - for putting letters in

13. Repetition. The right-hand member of each unit is a repetition of the concept referred to by the left-hand member:

    e.g. drink - a drink of water
    tap - a tap on the wall

14. Contiguity. The left-hand member of the unit is defined by direct concrete interaction of place, time or activity with the right-hand member:

    e.g. apple - grows on a tree
    late - you can see by the clock

15. Free association. The members of the unit are free associates:

    e.g. carry - heavy
    enjoy - fun

16. Connotation. The right-hand member of each pair connotes a relationship with the left-hand member:

    e.g. royal - strong
    modern - good

17. Analysis. The right-hand member is an analysis of the left-hand member indicating certain dimensions of function of this concept:

    e.g. rule - to control people
    lengthen - make a thing longer

18. Synthesis. The right-hand member defines the left-hand member by stating its relation with other concepts commonly associated with it:

    e.g. acorns - from an oak tree
    bunk - it has two levels

19. Extension of a class (Implication). The right-hand member of the unit gives examples of concepts to which the left-hand member might refer implying a degree of familiarity with the concept:

    e.g. bugs - insects and flies
    farming - crops and animals

20. Denotation in Context. The left-hand member is defined by use in context:

    e.g. sharpen - sharpen the knife till it cuts well
    bitten - bitten by a snake

21. Ostensive Definition. The right-hand member defines the left-hand member largely on the basis of experience:

    e.g. tickle - you make someone laugh
    selfish - all for yourself

22. Generic Definitions. The right-hand member denotes the common class to which the left-hand member belongs:

    e.g. kindle - burn
    cup - dinnerware

23. Class membership implied. The right-hand phrase attempts to bridge the gap between general and specific by using phrases such as "a kind of," "sort of" or "like a":

    e.g. cone - like an ice-cream cone
    stool - like a chair

24. Intension of a class (Genus et Differentia). The right-hand member states the class as well as the distinguishing features of the left-hand member:

    e.g. sipped - drank a little at a time
    notice - see and remember

The investigator then postulated the presence of a semantic space comprised of these kinds of semantic relations in the form of dimensions produced when several of the above noted semantic relations operate together within the individual's cognitive behavior. The kind of semantic relations (categories of meaning) and their

manner of "clustering" together was postulated to result in differing meaning spaces for individuals and consequently, differing verbal competencies.

Examination of the research revealed examples of definitions falling under each of the categories. These were all selected for use in the SF Test. Since one of the drawbacks of a paired comparisons type of instrument is the repetition of items being compared, it was decided that each category should be represented by twenty-four different examples, thus avoiding the repetition of a particular example. Consequently each pairing of a category with another employed a different expression of the category. To insure that the four major form classes of words (nominals, verbals, adjectivals, adverbals) were represented among the test items, words defined as each of these parts of speech were included. The classes were included according to proportions identified by Fries (1952) and adjusted for the age level of the sample. Wherever possible definitions were obtained from lists of children's definitions (Dale, 1960; Burns, 1960; Feifel and Lorge, 1950). Other examples were constructed on the basis of definitions elicited from children in other studies of children's qualitative knowledge of words. Table I provides a summary of the distribution of items according to part of speech. When all categories were filled, they were paired with each other according to the sequence 1-2, 2-3, 3-4, etc. This procedure generated

TABLE I

CATEGORIES OF MEANING
DISTRIBUTION OF PARTS OF SPEECH
OVER FORM CLASS

Category Number	Noun	Verb	Adjective	Adverb	
1		2	12	9	
2		3	13	7	
3	23				
4	23				
5	23				
6			14	9	
7	23				
8		23			
9	23				
10	23				
11	23				
12	23				
13		16	5	2	
14	21		1	1	
15		11	8	4	
16		2	21		
17		21	1	1	
18	23				
19	23				
20		17		6	
21		15	2	6	
22	22	1			
23	19	2	1	1	
24	19	4			
TOTAL	311	117	78	46	552
PERCENT (rounded)	56	21	14	8	100

the 276 pairs of items in the test with the results that no category appeared always first or last. The test was not sectioned but was organized as a single form.

The SF Test was untimed and the Ss were allowed to work until all had completed the test. Test instructions were presented in each test booklet along with sample questions and test administrators were instructed to discuss these instructions fully with the Ss before proceeding.

Instructions to the administrator were patterned upon those used in the California Test of Mental Maturity, as this test was also given in the study (see Appendix B).

Directions to the Student

This is a test to find out how you look at the meanings of words. You will be given many pairs of statements made up of words and their meanings. These meanings will be of many different kinds. For example, some words will be put together with their opposites, such as "hot - cold." Others will be matched with single words which could take their place, such as "car - automobile." Still others will be described, such as "skill - being able to do something well." There will be many other such statements. You will be asked to rank each pair of statements depending on how well you think the words on the left are described. These pairs are to be ranked by filling in the space on the answer sheet that stands for the word or statement you think is closer

in meaning to the word it describes and leaving blank the space that stands for the word or statement you think is not as close. There is no one best way to answer these questions. We simply want to see what you think are the best ways of giving meanings of words. Remember you are to compare the different ways you can give meanings for words. Do not worry whether the word has a complete meaning since each word is described in a different way. Think only of the kind of meaning given for each word and choose the one which is nearer what you think the word means in each pair of statements.

Here is an example of what one ranking might look like:

TEST

1. a. ____ big - large

   b. ____ cone - like an ice-cream cone

ANSWER SHEET

1. [redacted] b

Be sure to carefully fill in only one space for each question.

Sample

You will be asked to do this test by placing marks on answer sheets. Here are some questions for you to use in practicing the marking of the answer sheets. Your teacher will check your marking.

TEST

1.	a. ____	unwashed - dirty	(1)
	b. ____	yell - scream	(2)
2.	a. ____	moving - stepping	(3)
	b. ____	poppy - daisy	(4)
51.	a. ____	horseshoe - hard	(5)
	b. ____	rejoice - feel sad	(6)
52.	a. ____	amaze - you amaze me	(13)
	b. ____	cowhide - comes from cattle	(14)
101.	a. ____	satisfy - to fill the wishes of someone	(17)
	b. ____	skull - bones and skeleton	(19)
102.	a. ____	travel - when you go someplace	(21)
	b. ____	better - goodness	(22)

ANSWER SHEET

1. a b	51. a b	101. a b	151. a b
2. a b	52. a b	102. a b	152. a b

Vocabulary Control

Words used in the test were controlled in respect to difficulty. Two basic sources of children's vocabulary were employed: The Teacher's Word Book of 30,000 Words (Thorndike and Lorge, 1959) and Children's Knowledge of Words (Dale et al., 1960). Only those words in the Thorndike and Lorge list having a word count of twenty to AA inclusive were considered suitable while only the grade four words were used in the Dale list. In the spring of the year when the major study was conducted most of the students in grades five and eight should have been able to read easily all the items in the test.

The Thorndike and Lorge word list was selected because it was based upon a count of words in the reading material to which students are exposed. Since much of a student's knowledge of words comes from his experiences with them in written form, it was considered appropriate for this study to choose a list compiled from such writings. The Dale list was chosen because it contained words of current usage by children and, more importantly, the definitions of these words as given by the children.

Certain limitations of the Thorndike and Lorge list were noted. The original edition was published in 1944 and although it underwent its third printing in 1959, no further revision appears to have been made. Thus, many definitions were not used in the test items because they were not included in the list. The problem of recency of usage was overcome, in part, by use of the Dale list, a more recent compilation of children's vocabulary. Also, since the nature of the test did not demand a broad sampling of vocabulary because it was concerned with identifying the kinds of semantic relations existing between word and referent, words of common usage were considered adequate.

Validation of Test Categories and Items

To aid in determining the content validity of the SF Test, both the categories and the items comprising the test were examined by independent judges. In examining the categories of meaning, five judges were employed,

all possessing the equivalent of a bachelor's degree or better in terms of professional qualifications. The extent of agreement among judges and between judges and the investigator ranged from .80 to .95 on all but one category when judges were set the task of classifying items in five categories of meaning at one time. Five logical groupings of categories were established for purposes of validating test materials. These were the: (1) similarity group, e.g., synonym and similarity categories; (2) relation group, e.g., co-ordinate and attribute categories; (3) action group, e.g., action-upon and action-of categories; (4) explanation group, e.g., explanation and contiguity categories; (5) class-membership group, e.g., extension of a class and generic definition categories. Judges, given the 120 items for the five categories, i.e., twenty-four equivalent items per category, were asked to place the items in the appropriate categories. The category showing least agreement, explanation, was later dropped from the test. All items were classified under one or another of the twenty-four existing categories indicating the inclusiveness of the meaning categories selected. On the basis of this exercise and the research evidence cited above (Annett, 1959; Burns, 1960; Feifel and Lorge, 1950; Flavell, 1959) the investigator concluded that these categories represent an adequate sample of the universe of types of meaning responses.

To determine the adequacy of the twenty-three items falling under each category in terms of their suitability as exemplars of that type of definition as well as their suitability relative to their familiarity for children of this age group, judges examined the lists making up the test materials. The five students of a doctoral course in reading at the University of Alberta judged the 276 items on the basis of the criteria noted above. The examination resulted in a number of changes to the items, the final result being as exhibited in Appendix B. Changes suggested were basically of three kinds: (1) choosing words more familiar to Alberta children, e.g., bird - robin rather than bird - sparrow and oats - wheat rather than corn - wheat; (2) choosing more common exemplars of the semantic relation in the category, e.g., cones - from a pine rather than acorns - from an oak tree and horse - for riding rather than inkwell - for holding ink; (3) removing instances of duplication of items in a category.

A further determinant of validity were the results of the pilot study, a summary of which follows. This study produced evidence upholding the thesis of a multi-dimensional meaning space varying in its dimensions as certain meaning related variables were altered. This evidence was considered sufficiently supportive of the theoretical position to warrant the investigation reported in this dissertation.

III. THE PILOT STUDY

A pilot study to investigate the validity of the theoretical position, test format, and analytical techniques as well as the reliability of test results was carried out during the spring of 1969.

Sample

The sample was drawn from all grade IV, V and VI students at the East Elementary School in Leduc, Alberta. Eighty-four subjects comprising ninety-one percent of the population of children in these grades at this school were tested. The characteristics of this sample are analyzed in Table II.

Procedure

To meet the purposes of this pilot study which were to examine the suitability of test format and to establish validity of the instrument on a limited scale, groups of subjects similar to the eventual target population were tested under experimental conditions consisting of a regular classroom setting. Each class of students took the test in half-hour sittings extending over a period of time sufficient for completion of the task. Most subjects completed the test in less than sixty minutes.

Responses were scored by means of the IBM Optical Mark Scorer in the Department of Educational Research Services of the Faculty of Education at the University

TABLE II

THE PILOT STUDY SAMPLE
GRADE IV, V, & VI SUBJECTS (N = 84)

Grade	Boys	Girls	Mean Age	Mean I.Q.	Full Range I.Q.
4	16	12	9.2 years	113	95 - 159
5	17	13	10.75 years	109	86 - 131
6	10	16	11.17 years	107	86 - 142
Sub Totals	43	41			
Total	84				

of Alberta. In addition to analysis by multidimensional scaling using both group and individual differences models which provided the principal source of evidence for the identification of dimensions, selected statistical tests were employed to provide evidence regarding the validity and reliability of the instrument.

Cross-validation of the instrument was performed by splitting experimental groups and examining results thereby obtained.

Results

Table III shows loadings on six dimensions of the final configuration of the multidimensional scaling procedure[1] for Grades IV, V, and VI.

Considering the categories contributing to dimensions for each grade group and the loadings on categories, the dimensions have been identified as follows in Table IV:

TABLE IV

DIMENSION DESIGNATION
FOR THE MULTIDIMENSIONAL SCALING PROCEDURE
ON THE SEMANTIC FEATURES TEST - GRADES IV, V, & VI

Dimension Number	IV	V	VI
1	Similarity	Class-Action I	Class Implied
2	Comparison	Relation II	Relation III
3	Example	Experience	Association II
4	Relation I	Association I	Generic
5	Analysis I	Analysis II	Class-Action II
6	Class-Association	Class-Action	Class-Purpose

[1] This technique is discussed in Ch. IV, "Experimental Design"

TABLE III

MULTIDIMENSIONAL SCALING - DIMENSION LOADINGS ON FINAL CONFIGURATION[a]
FOR THE SEMANTIC FEATURES TEST - GRADES IV, V, & VI

	DIMENSION LOADINGS[b]																	
	DIMENSION I			II			III			IV			V			VI		
	GRADE																	
VARIABLES	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6	4	5	6
Synonym						-.690	-.861							-.647				
Similarity	-.808		-.679															
Supraordinate		-.595	-.688							-.753	-.574							
Coordinate			-.750		-.615								-.703					
Attribute					-.570	-.673	-.634											
Contrast				-.953	-.582				-.600									
Action-of		-.558											-.590		-.781			
Action-upon				.723													-.767	-.662
Whole-part															-.705	-.704	-.763	
Part-part										.677	.653							-.800
Common-use			-.858						.588	.773								
Use-of	.571														-.664		.706	
Repetition	.682	.655	.677															
Contiguity			.541	.615	.806													
Association									.662		.750		-.760					
Connotation										.840	.622				-.773			
Analysis												-.798	.890	.736				
Synthesis																.638	.697	.627
Extension	.669	.949	.852															
Context				.836	.789	.898												
Ostensive							.905	.812	.873									
Generic										.613	.737	.925						
Class Implied													.682	.671	.918			
Intension																.842	.668	.865

[a] Stress - Grade IV = 0.16, Grade V = 0.16, Grade VI = 0.16

[b] Loadings on six dimensions for all grades shown for ease of comparison
Only highest loadings of categories on dimensions are shown

It was decided, on the basis of their stress value and psychological characteristics, that six dimensions meaningfully and adequately defined the meaning space of each group. Kruskal (1964, p. 3) considers stress (goodness of fit) of 0.10 to 0.20 to be "fair" and since no "elbow" (Kruskal, 1964, p. 16) appeared in the stress value for dimensions a level of 0.16 was considered satisfactory in explaining group meaning space. Test data were also subjected to statistical tests. Evidence from these tests and the high stress level were considered to indicate the absence of a single, common meaning space for children in each group. This suggested that wide variations existed within each grade.

The dimensions structure for each group (Table III) and their designations (Table IV) showed that there was relatively little variation in the nature of meaning space between grade groups. This was confirmed by the Factor Match Test. Subjects at this level appeared generally to use similar strategies in determining word meaning although a qualitative change was evident. (See Appendix C).

Results of the cross-validation were consistent with expectations. (Appendix C) There was generally more agreement on dimensions within grade level than between grade levels although this difference was not striking which reinforced the contention that there were marked individual differences within groups. Furthermore, it

suggested again that children within this age range have similar kinds of meaning space.

The Individual Differences Model (Tucker and Messick, 1963) identified eighteen "Idealized Individuals" in the three classes. Of the eighteen viewpoints identified, there were five present in Grade IV, six in Grade V, and seven in Grade VI. Table V shows loadings on dimensions for Individual 2 in Grade IV and Individual 7 in Grade VI. Table VI summarizes the nature of meaning space and certain pertinent characteristics of the "Idealized Individuals."

Table VII shows the means and reliability obtained through an item analysis of the subjects' responses when the key used was provided by the responses of a teacher in the experimental school. The purpose of this analysis was to obtain some index of the degree to which children's responses approach those of an adult. The data indicated a nonsignificant difference ($p \simeq .20$ between Grade IV and Grade VI) between the means of the three groups. The subjects did not appear to vary significantly as grade groups in terms of approaching the adult responses. Finally, the KR-20 being high showed that the test measured word meaning reliably.

In Table VIII the Friedman analysis on the frequency of choice of categories provided evidence that

TABLE V

MULTIDIMENSIONAL SCALING - DIMENSION LOADINGS ON FINAL CONFIGURATION[a]
FOR THE SEMANTIC FEATURES TEST - INDIVIDUAL #2 GRADE IV & #7 GRADE VI

	DIMENSION LOADINGS[b]											
	DIMENSION I		II		III		IV		V		VI	
	INDIVIDUAL											
VARIABLES	2	7	2	7	2	7	2	7	2	7	2	7
Synonym			-.871	.658				.643			-.798	
Similarity									-.878			
Supraordinate		.920								.748		
Coordinate	-.833				-.630					.742		
Attribute												
Contrast										.591		
Action-of	-.704		-.727	.734								
Action-upon		.918									.900	
Whole-part				.647								
Part-part						.610	-.660	.611				
Common-use							.768					
Use-of										.744	-.684	.861
Repitition												
Contiguity					-.809	.644					.649	
Association	.957											.762
Connotation									-.673			.773
Analysis								.538			-.676	
Synthesis							.743	.800				
Extention			-.618					.436				
Context			.648									.752
Ostensive								.838	.967			
Generic									-.582	.522		
Class Implied			.725	.776								
Intension	-.693					.646						

[a] Stress - Individual 2 = 0.13, Individual 7 = 0.123
[b] Loadings on six dimensions for two individuals shown for ease of comparison
Only highest loadings of the categories on dimensions are shown

TABLE VI

A

MEANING DIMENSIONS AND PERSONAL CHARACTERISTICS FOR IDEALIZED INDIVIDUAL NUMBER 2 GRADE IV

Dimension Number	Dimension Designation	Characteristics of Idealized Individual	
1	Comparison	I.Q.	- 109
2	Example	Age	- 9.3 years
3	Experience	Sex	- Male
4	Use	Place of Residence	- Urban
5	Association		
6	Relation I		

Stress 0.131

B

MEANING DIMENSIONS AND PERSONAL CHARACTERISTICS FOR IDEALIZED INDIVIDUAL NUMBER 7 GRADE VI

Dimension Number	Dimension Designation	Characteristics of Idealized Individual	
1	Description	I.Q.	- 100
2	Class Implied	Age	- 12.2 years
3	Relation II	Sex	- Female
4	Experience	Place of Residence	- Urban
5	Similarity		
6	Association		

Stress 0.123

TABLE VII

ITEM ANALYSIS - SELECTED STATISTICS
THE SEMANTIC FEATURES TEST

Grade	Test Mean	Test Variance	KR-20 Reliability
4	155.75	429.83	.8884
5	159.53	348.32	.8582
6	160.96	351.58	.8642

TABLE VIII

FRIEDMAN ANALYSIS BETWEEN VARIABLES
AND KENDALL COEFFICIENT OF CONCORDANCE (W)
ON THE SEMANTIC FEATURES TEST CATEGORY FREQUENCIES

Grade	Chi Square	p	Kendall (W)	p
4	135.151	.001	0.210	.001
5	201.139	.001	0.292	.001
6	175.111	.001	0.293	.001

there were significant differences among the categories of meaning forming the elements of the test. In addition, Kendall's (W) showed that the subjects in each group came from the same population, i.e., there is significant agreement among individuals in the use of categories.

The Kruskal-Wallis analysis of variance of category frequencies, Table IX, showed four of the categories were ranked significantly differently by the three groups ($p \leq .05$) while the remainder did not achieve significance (Chi Square required for significance at $p \leq .05 = 5.99$). Kendall's (W) (0.229) shows a significant agreement among subjects considered as a total group.

Discussion

The dimensions which were identified in analysis of the data were not entirely as predicted. Relatively distinctive kinds of meaning space or strategies of signification were postulated for different grades. The data gave evidence of relatively congruent kinds of meaning space between groups but also indicated presence of considerable variation within groups. Individuals appeared to develop their meaning space in highly idiosyncratic ways influenced apparently by environmental and ontogenetic factors. This was also seen in the results of the item analysis which showed the three groups having almost identical means and a nonsignificant difference among groups in test variance or spread. Kendall's (W) supported the contention that there was some

TABLE IX

KRUSKAL-WALLIS ANALYSIS OF VARIANCE
ON THE FREQUENCY OF USE OF CATEGORIES OF MEANING

Variable	1	2	3	4	5	6	7	8
H	9.222*	1.605	2.284	1.443	7.290*	4.582	8.360*	3.047
Variable	9	10	11	12	13	14	15	16
H	2.544	3.337	2.209	0.458	1.695	1.592	3.673	0.908
Variable	17	18	19	20	21	22	23	24
H	0.954	4.038	0.483	0.488	3.419	6.405*	3.757	1.211

Kendall's (W) = 0.229**

Chi Square = 442.721** df = 23

* $p \leq .05$

** $p \leq .001$

within-group variation in response.

Results of the Kruskal-Wallis Analysis of Variance provided valuable evidence in the analysis of dimensions withdrawn from the data. This test showed that the four variables which were used significantly differently between groups were the synonym, attribute, action-of, and generic definition categories. These categories are highly important in the individual's ability to attribute mature, complex meanings to words such as the concept of class membership. It is these types of semantic relations that other investigators have found to provide the qualitative difference between kinds of meanings individuals give to words (Burns, 1960; Feifel and Lorge, 1950; Annett, 1959).

Labelling of dimensions was done with considerable tentativeness considering in each case the loading of meaning categories on dimensions as well as the psychological processes inherent within them and their relationships with each other. Ten distinct dimensions emerged for the three groups. Eight other dimensions were identified which were common to at least two groups of Ss. These appeared to be variants of more general dimensions. The composition of each dimension for each group is depicted in Table III. As noted previously, there was a certain lack of consistency in the emergence of high loading elements on these dimensions although generally the results were congruent with studies wherein

the investigator classified definition responses elicited from students into what were considered to be an inclusive and exclusive set of categories (Feifel and Lorge, 1950; Burns, 1960).

The lack of marked variation in dimensions between groups appeared to be in part an artifact of the data analysis program which blends individual meaning spaces together in deriving the average structure for each group. The main attributes of the spaces thus appeared essentially identical since individual differences were largely obliterated.

Also, it appeared that the characteristics of children's cognitive organization may be such that subjects within the experimental age range operate generally at a common level. The mean ages of subjects within the sample were between 9.0 and 11.75 years, highly significant in terms of Piaget's stage theory of mental development (Inhelder and Piaget, 1958, 1964; Inhelder, 1962). This age group falls within Piaget's concrete operations stage.

At the concrete level of operations the child's thinking is governed by some of the rules of logic but is still restricted when compared to the level of formal operations. His thinking does not possess complete generality (Le Francois, 1967, p. 169). His thinking deals with real and visible objects or those capable of evocation. While his thinking deals with classes, it does

not take into account the product of these classes.

In examining the dimensions which were identified in analysis it became apparent that these subjects were cognizant of the value of a class membership type of definition. It was also evident that these children used the more mature concept of definition by class membership and the generic definition with varying degrees of effectiveness. Younger children tended to possess dimensions of meaning which were less logically consistent. For example, Grade IV children distributed categories representing a class membership type of definition among all dimensions while Grade VI children grouped these categories into two or three dimensions. This was also true of other categories of meaning and semantic relationships such as the action category. Flavell (1963, p. 204) has pointed out that:

> Just as the various content areas resist a single, once-for-all structuring by the concrete-operational child, so his various cognitive structures -- adequate though they may be in their own separate domains -- fail to combine into the unified whole necessary to manage certain complex tasks.

Vinacke (1952) and Ausubel (1963) state that with maturation and experience children tend to demonstrate increasing ability to comprehend and manipulate abstract verbal symbols and to infer the properties of objects from their class membership rather than from direct sensory experience. Also, they cite evidence that concepts and meanings vary in the consistency or adequacy of their organization for different individuals. Welch and Long

(1940, 1942) contend that children's conceptual activity develops from simple to complex and concepts organize themselves into hierarchies of levels.

The data from this study supported these positions in that there was a gradual increase in the quality of meaning dimensions with increase in age although the experimental sample appeared to be generally functioning at the same level. Feifel and Lorge (1950), Annett (1959), and Burns (1960) have shown that certain ways of defining words are associated with greater efficiency and competence in verbal behavior. Results of the individual differences model were more indicative of such variations in meaning space than the group model.

Idealized viewpoints showed marked qualitative variations in the nature of meaning dimensions. The personal characteristics of these "composite" individuals were derived by averaging the characteristics of the constituent persons. Idealized Individual 2 in Grade IV, a boy living in town, appeared to have a relatively immature, highly concrete meaning space. He looked for meanings through experience, use, example, and other such concrete, perception-bound processes (Table VI, A). His strategies of signification would limit him to perceiving and comprehending the relatively simple, immediate, and superficial kinds of meanings in concepts and would probably prevent his understanding higher order (abstract) relationships or solving problems having such relationships.

as in literature or social studies.

Individual 7 in Grade VI showed a different sort of competence. This individual, a girl living in town, had begun to develop more inclusive and abstract dimensions such as "Class Implied" and "Relation II" which involved the class membership concept (Table VI, B). By applying these dimensions of meaning, this individual should have been able to perceive higher order relationships enabling her to manipulate concepts not having direct sensory referents such as the idea of tragedy or types of humor in literature.

The relative congruence of dimensions between grade groups as evidenced by the Factor Match Test could be attributed to the common stage characteristic of the sample. The lack of greater congruence within grades in the cross-validation procedures could also be attributed to the above factor since there appeared to be at least as great within group variations as there were between group variations. A greater age spread could be assumed to show greater between group differences.

Turning to the validation of the instrument, in examining the content validity of the Semantic Features Test the investigator had five qualified judges (public school teachers) classify test items into the twenty-four categories of meaning used in the test. Agreement among judges and between judges and the author ranged from .80 to .95. All items were classified under one or

another of the existing categories indicating the inclusiveness of the categories selected.

Matters relating to construct validity of the test have been noted in the "Results" section above. These data indicated general confirmation of the theoretical position and the assumption upon which the test was constructed. The Friedman Test provided evidence that the variables constituting the test measured differing aspects of meaning thus providing support for the contention that the instrument samples broadly from the ways in which word meaning can vary. In addition the KR-20 values obtained in the item analysis, being an index of internal consistency, showed that the test measured the attribute of meaning reliably (Ferguson, 1966, p. 379).

The instrument, therefore, appeared to be suitable for identifying and delineating the dimensions of meaning space of children both in terms of a general structure of meaning for groups and for individuals within these groups. The test, it was seen, was sensitive to small changes in cognitive organization. These changes were reflected in the meaning dimensions obtained through multidimensional scaling. Emergence of dimensions differing qualitatively with variation in such meaning related factors as intelligence, age, and experiential history confirmed the contention that individuals develop differential strategies of ascribing meaning to verbal

stimuli and that these "processes of signification" could be mapped to produce an index of the "meaning of meaning" for individuals.

Test Reliability

To determine the reliability of the test a comparison over time was made as well as obtaining a Kuder-Richardson estimate of internal consistency. The stability of the test was measured by the process of retesting the pilot study sample. A random sample of subjects from the pilot study repeated the test after a period of approximately one and one-half months. Responses were correlated using the variance interpretation of the correlation coefficient (Ferguson, 1966, p. 126). For the thirty-eight subjects involved in the retest, the percentage of times the same response was made was determined and then converted to a reliability coefficient. The range in correlations between tests for individuals was .67 to .82 with a mean of .73. The correlations, while not extremely high, are considered adequate since the test is designed to measure a changing characteristic. Response fluctuations over short periods are normal and a fairly substantial change over a period of a month or more was expected. In fact, "in some instances ... a low retest stability over a substantial period merely reflects true trait fluctuation and hence indicates desired validity" (French and Michael, 1966, p. 31). On the basis of this evidence, the SF Test was

considered to possess a sufficient degree of reliability to serve a diagnostic function.

SUMMARY

A new test of verbal ability, the Semantic Features Test, was constructed to determine the individual's ability to process words. This ability was defined in the form of dimensions of meaning comprised of certain logico-semantic relations found to exist in children's vocabularies. The twenty-four categories of meaning used in the test expressed these relations and formed the basic elements of the test which had a paired comparisons format.

The pilot study established the reliability of the test as well as providing preliminary data on the validity of its theoretical basis and format. Appropriate analytical techniques were also examined.

CHAPTER V

I. EXPERIMENTAL DESIGN

The research design employed in this study was a treatment by subjects plan. Treatment was the Semantic Features Test designed to index the dimensions of children's meaning space. Major purposes of the study were to investigate the concept of semantic space and examine the validity and reliability of the experimental vocabulary test.

II. THE SAMPLE

The experimental sample was selected to be representative of the target student population in Alberta. This selection was made on the basis of the following criteria:

1. Proportional representation according to population strata; urban, small town, rural.
2. Proportional representation according to sex and age in grades V and VIII, the two grades under investigation. These grades were chosen since the pilot study indicated relatively small differences between Grades IV, V, and VI.

Population strata according to place of residence were defined as follows for this study. An urban centre is a community of 19,000 or more people; a small town, a

community of 1,000 to 19,000 people; and a rural area of less than 1,000 people (Queen's Printer, 1967). The latest census data available for Alberta (Queen's Printer, 1967) classified 52 percent of the population as urban residents, 12 percent as small town residents, and 36 percent as rural residents.

Distribution by sex in Grade V and VIII was found to be 53 percent boys and 47 percent girls.[1] Age was considered to be randomly distributed within each grade group as a result of compulsory attendance regulations.

Selection of Subjects

To provide a stratified random sample representative population centres were chosen according to the criteria set down. Three communities in central Alberta were selected by the investigator in consultation with the Alberta Department of Education's consultant for elementary education in the area. Ten schools within these communities were selected by school officials upon the criteria of the school's being representative of each type of population stratum, i.e., urban, small town, and rural. Also considered was the willingness of school personnel to cooperate in the study. Depending upon the size of the school, either the total population in grades five and eight or the students in a randomly selected room in the school were selected for study. A total of 434 individuals received the treatment.

[1] Figures obtained from the Department of Education, Province of Alberta, Master Enrolment Table, October, 1968.

Final Sample

Upon return of the completed tests, the final sample was selected on the basis of the proportions specified in the criteria for selection. Table X analyses this sample. A small number of Ss had not completed both the Semantic Features Test and the California Test of Mental Maturity and were deleted from the sample. From the remaining students, the final sample was selected on the basis of the criteria of representation in the total population according to place of residence, i.e., 52 percent urban, 12 percent small town, and 36 percent rural. Subsequent to these adjustments, 266 students remained in the sample.

III. DATA COLLECTED

Semantic Features Test Data

The Semantic Features Test was designed and constructed to obtain data about children's meaning space as outlined in Chapter IV. Ss selected one element of a pair of semantic relations in each of 276 items on the test. The data indicated the importance of certain semantic relations in the Ss semantic behavior.

California Test of Mental Maturity Data

Since the major purpose of the study was to validate both the theory and the test used in the study a standardized test was used for purposes of comparison.

TABLE X

THE EXPERIMENTAL SAMPLE
GRADE V & VIII SUBJECTS (N = 266)

Population Stratum	Grade Five		Grade Eight		Total
	Boys	Girls	Boys	Girls	
Urban	36	32	37	32	137
Small Town	9	8	8	9	34
Rural	24	24	24	23	95
Sub Totals	69	64	69	64	266
Totals	133		133		266
Percent of Total	52%	48%	52%	48%	

The test selected was the California Test of Mental Maturity Short Form, Levels 2 and 3. This test was originally based on a psychological analysis of the operations involved in the Stanford-Binet scale (Sullivan, in Horrocks, 1964, p. 24). The short form of the CTMM contains seven subtests grouped under four major factors of mental functioning. In speaking of the factors measured by the CTMM, its authors state:

> It is important to note that these were "psychological factors" or logical constructs based on assumptions about higher mental processes; e.g., numerical reasoning, rather than the mathematical factors of a factor analytic method ... (Sullivan et al., 1957).

This feature of the test made it desirable for the present study since the investigator also postulated certain "psychological factors" or dimensions defining an individual's meaning space. The relationship between subjects' responses on the two instruments, the CTMM and the SF Test, were thus considered to be important in interpreting the results of the new test.

While there has been criticism of the CTMM use of the term "factors" for components not arrived at by means of factor analysis, CTMM authors do state:

> ... factor studies have demonstrated that about the same number of mathematical factors of essentially the same content is necessary to explain each of the ... levels of the C.T.M.M. (Sullivan et al., 1957).

In fact, the 1963 revision based on "... Factor analysis by the Thurstone centroid method produced four discrete factors which form major interpretive units of the 1963

Short-Form" (Sullivan et al., 1963).

Concerning validity of the CTMM, intercorrelations with other tests:

> ... range from a highly satisfactory .88 with the Stanford-Binet to a low of .39 with the non-verbal SRA. These correlations would appear to indicate that the CTMM would act as a useful substitute at higher levels ... [for individual tests] (Horrocks, 1964, p. 248).

Horrocks adds that correlations between language and non-language scores of the CTMM provide adequate "... reason to assume that the two sections are tapping somewhat different domains of intellectual functioning" (1964, p. 249).

Taking both the advantages and the weaknesses of the CTMM into consideration, the investigator chose that test for administration since no more adequate group test of verbal and/or intellectual functioning similar to the SF Test was available.

Place of Residence

An important variable in language arts investigation is population strate of Ss (Robertson, 1966). Data on place of residence; urban, small town, and rural of children in the sample was collected at the time of testing. These data were used in obtaining the final sample according to the proportions previously established for Alberta's population strata.

Sex of Subjects

School census data indicated that the number of

boys was greater than the number of girls. This information was used in determining the composition of the final sample.

Socio-economic Status

An influential factor in children's vocabulary is their socio-economic status (Russell, 1954, p. 365). An index of this factor was obtained through the identification of the occupation of the parents and interpreted according to the Occupational Class Scale (Blishen, 1968). During the testing session, the father's and the mother's occupations were recorded. Socio-economic status data were used in describing the nature of the idealized individuals. This information suggested the operation of SES in semantic development.

Age of Subjects

The age of Ss were recorded at the time of testing. Age ranges were: Grade V - 10 to 12 years and Grade VIII - 13 to 15 years. The influence of age upon semantic space was examined in the Individual Differences Model, Multidimensional Scaling.

IV. PROCEDURES FOR COLLECTION OF DATA

Since the greater proportion of the population of Alberta is concentrated in the north central area of the province, a small city in this region was considered to be representative of an urban setting in Alberta. Three

elementary and three junior high schools were selected by school officials on the basis of their representativeness of such schools in the city. The choices were restricted by the desire of school personnel to participate in the study. A single room was chosen in each of the schools to conduct the testing.

Upon the advice of the Elementary Education Consultant of the Alberta Department of Education stationed in central Alberta, two small towns were selected as the small town sample. Subjects were selected from the total Grade V and VIII population in the schools.

Similarly two centralized schools in a rural setting were selected to represent the rural population. In each case, all students were tested.

The collection of the data extended over the period May 12 to May 23, 1969. In each classroom children were given the tests by their teacher to maintain a normal classroom atmosphere.

V. TREATMENT OF THE DATA

The subjects' answers on both the Semantic Features Test and the California Test of Mental Maturity were scored by the Optical Mark Scorer.

Statistical analysis was carried out using the facilities of the Division of Educational Research Services of the University of Alberta, Edmonton.

Multidimensional Scaling

Scale values were assigned to each stimulus (category of meaning) on the basis of the proportion of times each of the stimuli is preferred to each of the other stimuli when the stimuli are presented two at a time (Torgerson, 1958). Subsequently, the proportions of times each preference was made was used to compute the location of n points in an m dimensional space, such that the distances between the points are monotonically related to the experimentally determined dissimilarities between pairs of points (Kruskal, 1964(b). An individual differences model was then used to determine the number of idealized individuals (Tucker and Messick, 1963). Dimensions were also identified for these "individuals." This analysis identified the dimension of meaning space of the subjects indicating the differing strategies used in signification.

Factor Matching

The Ahmavaara Factor Match Test was used to determine the congruence of the dimension patterns obtained (Ahmavaara, 1954).

Item Analysis

Using the responses of a teacher in one of the experimental schools as the key, an item analysis was conducted to determine the extent to which the subjects' responses approximated those of an adult. The test

reliability, using the Kuder-Richardson 20 formula, was also computed (Ferguson, 1966, pp. 379-380).

Analysis of Variance

An analysis of variance on the CTMM scores was conducted to determine the significance of differences in responses between idealized individuals. An analysis of variance using non-parametric statistics was applied to responses on the SF Test to determine the significance of differences between experimental groups and within each experimental group.

Correlation of the SF and CTMM Tests

Using all the subjects within each group (N = 133 & 133) correlations were determined between the frequency of choice (out of a possible 24) with the proportion of correct responses on the CTMM. This procedure showed the relationship between components of the two tests.

Factor Analysis with Oblique Rotation

A principal-axes factor analysis and Promax rotation were conducted on the data of the SF Test to determine the comparability of factor patterns of this technique with that of multidimensional scaling.

SUMMARY

In the treatment by subjects research design for this study, the treatment was the Semantic Features Test

and the subjects were 266 children, a stratified random sampling from students in grades V and VIII, in urban, small town and rural Alberta schools.

Data were collected from the SF Test and the CTMM. The age and sex of subjects were recorded as was parental occupation.

The data produced by the tests were subjected to appropriate statistical treatment involving paired comparisons scaling, multidimensional scaling, factor matching, analysis of variance, computations of correlations, and principal-axes factor analysis with oblique rotation.

The use of randomized sampling procedures and the statistical treatment of data were used to control the variables in the study.

CHAPTER VI

FINDINGS: METHODOLOGY

The purpose of this chapter is to present the findings of the analysis of the data pertaining to the operation of the Semantic Features Test. The main sections are: analysis of test characteristics, conducated to obtain information upon reliability and validity of the test; correlations of the Semantic Features Test and the California Test of Mental Maturity to further examine test validity; and factor analysis with oblique rotation to examine the suitability of the mathematical model underlying the multidimensional analysis.

I. ANALYSIS OF TEST CHARACTERISTICS

Test Mean and Reliability

An item analysis was performed upon the data to obtain information about test reliability and the test mean. Table XI shows the results of an item analysis when the key for scoring was provided by the responses of a teacher in the pilot study school. This individual was considered to provide one typical adult response. Operating on the assumption of growth in semantic competence (Burns, 1960; Feifel and Lorge, 1950) the change in test mean was considered to indicate development in

verbal ability. Although variations will exist among adults as well as children, the responses of a teacher were considered representative of one kind of adult competence.

TABLE XI

ITEM ANALYSIS - SELECTED STATISTICS
THE SEMANTIC FEATURES TEST

Grade	Test Mean	Test Variance	KR-20 Reliability
5	158.87	305.27	0.8038
8	162.47[a]	324.65	0.8323

[a]Difference between means significant p = .025 (one-tailed test).

These data indicated an acceptable level of internal consistency. The Kuder-Richardson Formula 20 statistic showed that the test measures word meaning reliably. Further, the significant increase in the test mean from grade five to grade eight was indicative of the anticipated developmental characteristic of children's semantic competence. It also pointed to the diagnostic potential of this test. The sensitivity of the test to qualitative changes in language ability suggested its possible use in identifying the level of functioning of groups and individuals. The test variance indicated that variations occurred to a considerable degree among individuals in both groups.

The level of significance of differences, p = .025,

was not remarkably high. This was in part an artifact of the statistical procedures employed. In the item analysis all subjects were grouped together producing an average value for each group. The high variance present within groups attested to the presence of considerable individual variation. Thus, the averaging procedure camouflaged much of the variation that existed. The use of the SF test as a diagnostic tool would, therefore, be dependent upon its ability to identify these individual variations and the cost of implementing changes within the educational program.

Two Way Analysis of Variance - Repeated Measures

To determine the relationship between responses on categories in the two treatment groups, a two-factor analysis of variance, grade by category of meaning, with repeated measures on factor "B", categories of meaning, was carried out. This test was employed to provide additional evidence upon the differences revealed by the item analysis procedure. Total responses in each category of meaning were assumed to represent an interval scale of measure. Table XII presents the results of this test.

The highly significant interaction ($p = .00000$) pointed to the great variation in use of particular categories of meaning by the two treatment groups. This statistic justified the identification of a unique meaning space for each group. Subsequent to the identification of interactions an analysis of simple main effects,

TABLE XII

SUMMARY OF ANALYSIS OF VARIANCE

FACTOR A. SUBJECTS - GRADES FIVE AND EIGHT
FACTOR B. CATEGORIES OF MEANING

Source of Variation	SS	DF	MS	F	p
BETWEEN SUBJECTS	22.063	265			
"A" Main Effects	0.520	1	0.520	6.454	0.0116
Subjects Within Groups	21.250	264	0.080		
WITHIN SUBJECTS	88145.657	6118			
"B" Main Effects	31298.219	23	1360.792	148.865	0.0
"A * B" Interaction	1340.395	23	58.278	6.375	0.00000
"B" x Subject Within Groups	55504.937	6072	9.141		

employing nonparametric statistics, was conducted. This analysis is reported in the following section.

Analysis of Variance Using Nonparametric Tests

The Friedman analysis, analogous to a two-way analysis of variance, was conducted to determine whether the twenty-four categories of meaning were used differently by the treatment groups. The Kendall Coefficient of Concordance was also obtained to test the degree of agreement about use of categories among the subjects. A one-way analysis of variance, the Kruskal-Wallis test, was conducted between Grades V and VIII on each category to determine the degree to which individual categories are used. Since the original data were on an ordinal scale of measurement, nonparametric tests were used. Tables XIII and XIV present the results of these two analyses.

The Friedman test, Table XIII, provided evidence that there were significant differences in the frequency with which individuals in each grade used the twenty-four categories of meaning. Subjects in each treatment group used the meaning categories purposefully; their choices were not made randomly. Kendall's W showed that the students in each grade used individual categories with similar frequency. This statistic measured the extent of the association among the choices of individuals. The significant value of W suggested that the subjects were applying essentially the same standard in using the

TABLE XIII

FRIEDMAN ANALYSIS BETWEEN VARIABLES
AND KENDALL COEFFICIENT OF CONCORDANCE (W)
USING FREQUENCY OF RESPONSE IN CATEGORIES OF MEANING

Grade	Chi Square	p	Kendall W	p
5	783.823	.001	0.256	.001
8	1224.339	.001	0.400	.001

TABLE XIV

KRUSKAL-WALLIS ANALYSIS OF VARIANCE
USING FREQUENCY OF RESPONSE IN CATEGORIES OF MEANING

Variable	H	Sums of Ranks Relationship between Grades
Synonym	13.718***	5 > 8
Similarity	1.088	
Superordinate	0.060	
Coordinate	0.713	
Attribute	1.045	
Contrast	0.714	
Action-of	0.231	
Action-upon	2.926	
Whole-part	0.021	
Part-part	10.104**	5 < 8
Common-use	0.505	
Use-of	0.228	
Repetition	13.713***	5 < 8
Contiguity	3.376	
Association	5.247*	5 < 8
Connotation	9.720**	5 < 8
Analysis	19.310***	5 > 8
Synthesis	0.085	
Extension	7.209**	5 > 8
Context	18.989***	5 < 8
Ostensive	2.685	
Generic	0.010	
Class Implied	4.627*	5 > 8
Intension	17.938***	5 > 8

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

categories comprising the test (Siegel, 1956). The data also show that there was more homogeneity of choice among the older students in the selection of categories of meaning than among the younger ones. The Kruskal-Wallis test reported in Table XIV, a one-way analysis of variance by ranks, showed that several of the categories were used differently when the choices of the two treatment groups were compared. This test also indicated which of the groups used the categories more frequently. The data show that the Grade V and VIII groups used certain categories more frequently indicating the possible existence of different dimensions of meaning space. These results are discussed in a subsequent section.

II. CORRELATIONS OF THE SEMANTIC FEATURES TEST WITH THE CALIFORNIA TEST OF MENTAL MATURITY

Correlations were computed between the experimental test and a standardized test of intellectual ability, the CTMM. This procedure was carried out for the purposes of checking the validity of the SF test against a standardized vocabulary test and to aid in interpreting the results of the SF test. The frequency of the subjects' responses in each SF category (out of a possible twenty-four) were correlated with the proportion of correct answers in each subtest of the mental ability test. Tables XV and XVI present these correlations for Grades V and VIII respectively.

TABLE XV

CORRELATIONS OF THE SEMANTIC FEATURES TEST AND THE CALIFORNIA TEST OF MENTAL MATURITY GRADE V[a]

SF Categories	CTMM Subtests 1 Opposites	2 Similarities	3 Analogies	4 Numerical Values	5 Number Problems	6 Comprehension	7 Recall
Synonym	-.206	-.252	-.171		-.297	-.385	-.238
Similarity					.204		
Superordinate	.254	.266					.225
Coordinate					.172	.199	
Attribute							
Contrast							
Action-of		.178					
Action-upon	.189			.320	.329	.418	.298
Whole-part						.172	
Part-part				.282	.188	.271	.206
Common-use							
Use-of		-.181		-.304	-.333	-.282	-.269
Repetition			.215	.184	.216	.247	
Contiguity							
Association				.256	.181	.199	
Connotation	.341	.357	.202	.277	.321	.427	.274
Analysis	-.198	-.192		-.281	-.332	-.441	-.258
Synthesis				-.224			
Extension						-.222	
Context							
Ostensive				-.248	-.186		
Generic							
Class Implied				-.277		-.235	
Intension	-.209	-.267	-.208	-.347	-.296	-.439	-.243

[a] Only correlations with probabilities .05 or greater are shown

TABLE XVI

CORRELATIONS OF THE SEMANTIC FEATURES TEST AND THE CALIFORNIA TEST OF MENTAL MATURITY GRADE VIII[a]

	CTMM Subtests						
	1	2	3	4	5	6	7
Categories	Opposites	Similarities	Analogies	Numerical Values	Number Problems	Comprehension	Recall
Synonyms					-.188	.275	-.223
Similarities							
Superordinate							
Coordinate							
Attribute							
Contrast							
Action-of							
Action-upon							
Whole-part							
Part-part					.204	.168	
Common-use							
Use-of							
Repetition					.168	.262	
Contiguity							
Association		-.185					
Connotation					.186	.312	-.178
Analysis				-.211		.328	
Synthesis	.198	.223					-.187
Extension							.178
Context							
Ostensive					-.231	.235	-.222
Generic	.173						
Class Implied							
Intension			-.259	-.194	-.265	-.240	-.253

[a] Only correlations with probabilities .05 or greater are shown

These data show that there was a greater correlation between subjects' responses on the SF and CTMM tests for Grade V than for Grade VIII. Also noted were some negative correlations among items. Although many of the Grade V correlations were of a low order (.200 or less) significant correlations ($p \leq .05$) existed in approximately 36 percent of the cases. Significant correlations were found in only 14 percent of the cases in the Grade VIII data. The probability of significance of correlations is directly related to sample size consequently interpretations must be made cautiously.

The Grade V results show that correlations were somewhat higher and more consistent between the number problems and comprehension subtests of the CTMM and a majority of the categories of the SF test than for other CTMM subtests. The synonym, action-upon, use-of, connotation, analysis, and intension categories of the SF test appeared to correlate most with the CTMM.

Grade VIII correlations were of a lower order than those in Grade V with the number problems, comprehension, and recall subtests showing the greatest degree of correlation with the SF test. The intension category of the SF correlated most with the CTMM with the synonym, connotation, analysis, synthesis, and ostensive categories also showing more correlation with the CTMM subtests although considerably less so than in Grade V.

Using the variance interpretation of correlation

it may be seen that the SF and CTMM tests had only between 3 and 20 percent of the variance in common. This indicated that the two instruments were measuring quite dissimilar components of semantic behavior. This result was not unexpected considering the nature of the two tests.

These results suggested that the SF test and the CTMM measured certain aspects of intellectual functioning in common but that the SF test also indexed other kinds of verbal behavior since certain of the categories on the SF test were not correlated with the CTMM, there was small amount of variance held in common, and there were some negative correlations.

The small degree of correlation between the tests at the Grade VIII level suggested that these older Ss bring a different quality of intellectual ability to bear upon the SF test. The CTMM Level 3 used for these students is similar in format to Level 2, the difference being the level of difficulty of each task. It, therefore, appeared that the Grade VIII Ss used categories of meaning differently from the Grade V individuals and that the CTMM was not able to tap this change in verbal behavior. These findings are examined in the "Discussion" section later in this chapter.

Subsequent to the identification of "idealized individuals" (see Chapter I) in each of the two treatment groups, their scores on the CTMM subtests were subjected

to analysis of variance. The five idealized individuals (Factor A) were compared on their scores on the CTMM subtests (Factor B). This was done to determine whether the verbal behavior indexed by the SF test is a reflection of mental ability measured by the CTMM or whether this behavior falls within another domain of intellectual functioning. Tables XVII and XVIII present the results of this analysis.

The data in Table XVII show that for Grade V the only significant difference was between subtests of the CTMM indicating a difference in response on different tasks by the Ss as a total group.

At the Grade VIII level there were significant differences between the five "idealized individuals" as well as between subtest results for the subjects. Since the subtests index different kinds of intellectual behavior, this result was not unexpected. Thus, this effect will not be analyzed further. The significant differences between individuals in Grade VIII but not in Grade V suggested a greater differentiation of intellectual functioning in the older Ss. This result was in keeping with other research (Vernon).

The data in Table XVIII show that the five "idealized individuals" in each grade identified by the Tucker and Messick (1963) procedure shared similar abilities as measured by the CTMM. Subtest #6 Verbal Comprehension was an exception. On the basis of the low

TABLE XVII

TWO-WAY ANALYSIS OF VARIANCE WITH REPEATED MEASURES
ON THE CALIFORNIA TEST OF MENTAL MATURITY
FACTOR A. IDEALIZED INDIVIDUALS
FACTOR B. CALIFORNIA TEST OF MENTAL MATURITY SUBTESTS

Grade V - Summary of analysis of Variance

Source of Variation	SS	DF	MS	F	p
BETWEEN SUBJECTS	3784.750	131			
"A" Main Effects	76.282	4	19.071	0.654	0.625
Subjects Within Groups	3704.437	127	29.169		
WITHIN SUBJECTS	18267.187	792			
"B" Main Effects	11694.332	6	1949.055	247.262	0.0
"A * B" Interaction	217.632	24	9.068	1.150	0.280
"B" x Subject within Groups	6006.500	762	7.883		

Grade VIII - Summary of Analysis of Variance

Source of Variation	SS	DF	MS	F	p
BETWEEN SUBJECTS	2534.937	131			
"A" Main Effects	181.086	4	45.271	2.425	0.051
Subjects Within Groups	2370.437	127	18.665		
WITHIN SUBJECTS	16931.750	792			
"B" Main Effects	11859.430	6	1976.572	305.456	0.0
"A * B" Interaction	177.613	24	7.401	1.144	0.287
"B" x Subject within Groups	4930.812	762	6.471		

TABLE XVIII

ONE-WAY ANALYSIS OF VARIANCE BETWEEN IDEALIZED INDIVIDUALS ON THE CALIFORNIA TEST OF MENTAL MATURITY SUBTESTS

Variable	Probability	
	Grade V	Grade VIII
Opposites	0.859	0.189
Similarities	0.859	0.253
Analogies	0.879	0.560
Numerical Values	0.163	0.364
Number Problems	0.233	0.599
Verbal Comprehension	0.083	0.034
Delayed Recall	0.968	0.519
Total Score	0.601	0.100

correlations between the SF and the CTMM tests, this result was expected (see Tables XV and XVI). Also on the basis of these low correlations and the need to examine the characteristics of idealized individuals it was decided to accept a probability level of 0.10 as significant. Although the overall interaction effect in Grade V was non-significant due to high probabilities on subtests, it was decided that the one-way analysis revealed a significant difference in verbal comprehension ($p = .08$). The Grade VIII group also showed significant differences in this subtest ($p = .03$).

These data suggest that the SF and CTMM comprehension subtest index a somewhat similar verbal comprehension ability. This was expected since both tests have to do with the meanings of concepts. Moreover, the more abstract semantic functioning of the older child, which was indexed by the SF test, was reflected in the greater differences between groups at the Grade VIII level.

In general, the non-verbal tests of the CTMM did not discriminate among "idealized individuals." Non-verbal tasks and verbal behavior appear to require different intellectual competencies.

III. FACTOR ANALYSIS

In addition to the nonmetric multidimensional scaling performed on the data, a principal-axes factor analysis of the semantic category frequencies was conducted to compare results of the two programs of analysis. Also, factors were subjected to oblique rotation to determine whether the assumption of an Euclidian space, i.e., the independence of factors underlying the dimensions in children's meaning space, could be upheld.

The analysis identified eight factors in Grade V and seven in Grade VIII having eigenvalues greater than one. Below this level, the amount of variance accounted for by the factor is no more than that for a single variable so that the factor contributes little to the reduction of variables by clustering them. This is the commonly accepted cut-off point for factors. Although eight and seven mathematical factors were identified for the two groups, it was considered that only five distinct psychological factors were present, corresponding to the results of the multidimensional scaling (see Table XIX and Appendix E). In each of the groups, two or more mathematical factors revealed similar psychological content. This resulted in five factors. Varimax rotated factors in both groups appeared similar to dimensions withdrawn through the scaling program.

TABLE XIX

PRINCIPAL-AXES FACTOR ANALYSIS ON THE
SEMANTIC FEATURES TEST GRADES V & VIII

VARIABLES	Communalities		Factor I		II		III		IV		V		VI		VII		VIII	
	Gr. 5	8	5	8	5	8	5	8	5	8	5	8	5	8	5	8	5	8
Synonym	.725	.705	∓.624					.618										
Similarity	.717	.501								.615			.828					
Superordinate	.650	.681	.616	∓.734										.774				
Coordinate	.628	.663			∓.458							.771			.786			
Attribute	.774	.641																
Contrast	.727	.689		∓.709							.751	.751						
Action-of	.594	.691																
Action-upon	.464	.578	.594			∓.723												.457
Whole-part	.495	.474				∓.494												
Part-part	.555	.659		∓.732	∓.590										.426			
Common-use	.611	.553				∓.591										.489		
Use-of	.631	.623	∓.496					∓.859	∓.798									
Repetition	.701	.798					.821									.635		
Contiguity	.719	.634								.739			.438					
Association	.531	.603								.564								
Connotation	.670	.581	.675															
Analysis	.632	.646	∓.556	.541						∓.518								
Synthesis	.531	.539					.571								∓.604	.639		
Extension	.751	.665						∓.746	∓.768									
Context	.662	.773																
Ostensive	.646	.614		.620	.670									.699				∓.762
Generic	.717	.740																
Class Implied	.496	.655			.416	.688												
Intension	.658	.606	∓.699	.444														
Percent of Total Variance	63.69	63.81	13.3	13.5	9.9	10.3	8.8	9.9	7.1	8.2	6.5	7.8	6.5	7.2	6.3	6.5	5.2	
Factor Names	Grade 5		Class-Action		Experience		Contiguity		Contiguity				Contiguity		Association II		Relation	
	Grade 8		Class-Experience		Function		Context		Association I				Class		Context			

The data in Table XIX show that the percent of total variance of factors for each experimental group was almost identical (63.69 and 63.81) although the Grade VIII group had fewer factors contributing significantly to the test variance. As with the scaling program, five factors in each case were considered to represent most adequately the psychological behavior underlying subject responses. Since the Kruskal-Shepard nonmetric multidimensional scaling procedure is more appropriate to the date generated by the test, the present factor analysis was used for confirmation purposes only and not interpreted in detail.

The factors were also subjected to oblique rotation. Table XX presents the correlations among oblique primary factors. The dimensions withdrawn through the multidimensional scaling program are located in Euclidian space which has orthogonal relationships between factors. The oblique rotation of factors performed in the principal-axes analysis show that most correlations between primary factors were of a low order. In only one instance did the correlation reach .50. This result was considered to indicate that the Euclidian space model used in the multidimensional scaling analysis was appropriate to the nature of behavior being investigated.

TABLE XX

PRINCIPAL AXES FACTOR ANALYSIS ON THE SEMANTIC FEATURES TEST
CORRELATION AMONG OBLIQUE PRIMARY FACTORS
LOWER TRIANGULAR MATRIX

Grade V

Variable	1	2	3	4	5	6	7	8
1	1.0000							
2	-0.4907	1.0000						
3	-0.2012	0.2506	1.0000					
4	0.1317	-0.2026	-0.1064	1.0000				
5	0.4714	-0.3506	-0.1847	0.2273	1.0000			
6	0.3724	-0.5404	-0.2862	0.1461	0.3467	1.0000		
7	0.3049	-0.3136	0.9653	0.0654	0.1808	0.4184	1.0000	
8	0.3331	-0.4123	-0.0656	0.2550	0.2490	0.2720	0.2336	1.0000

Grade VIII

Variable	1	2	3	4	5	6	7
1	1.0000						
2	0.4223	1.0000					
3	0.2367	0.2559	1.0000				
4	-0.1855	-0.0846	0.0512	1.0000			
5	-0.3557	-0.2396	-0.3158	0.0704	1.0000		
6	-0.3911	-0.4131	-0.1794	0.1005	0.3101	1.0000	
7	0.2168	0.2243	-0.1133	-0.2052	0.0356	-0.2379	1.0000

IV. DISCUSSION

The preceding section examined statistically the operation of the Semantic Features Test and the relationships between the test and the California Test of Mental Maturity. What follows is an attempt to evaluate these data and the relationships and discuss the underlying psychological processes.

Analysis of Test Characteristics

The purpose of the statistical analysis was to provide some objective evidence regarding the reliability of the experimental test and data relative to children's intellectual development. The measure of internal consistency of the present study approximated the results of the pilot study. Since the test-retest reliability using the pilot study sample was judged to be adequate, (see Chapter V) it was concluded the data of the major study would exhibit a similar behavior. Thus, considering the changing and changeable nature of the behavior under study, the test reliability was considered to be satisfactory.

The statistical tests employed in this portion of the analysis all pointed to significant differences in responses between Grades V and VIII. This finding supported the writer's contention that the instrument has a degree of validity as a measuring instrument as well as being of diagnostic potential.

Results of the item analysis showed that the test mean of the Grade VIII group was significantly higher than that of the Grade V group. This datum indicated that the older group had more responses in common with the adult selected to provide "key" responses for the test. The test mean for both groups was comparatively low, 158.87 for Grade V, and 162.47 for Grade VIII (total score = 276). This evidence suggested that further growth in semantic competence was possible for both groups but more so for the younger than the older. It also suggested that there was great variability in verbal behavior among individuals. It was recognized by the investigator that the set of responses of the particular adult selected in this case was only one of many possible such sets. Evidence from studies in the area of semantic abilities all points to the greater competence of adults and those with training in and experience with language. Therefore, it was assumed that the responses of this adult, a teacher holding a degree in education, would be representative of one kind of adult semantic competence and be a suitable criterion to index the degree of change between the two treatment groups.

Each group behaved similarly in ascribing meaning to concepts as evidenced by the coefficient of concordance. However, the older subjects apparently used fewer, more consistent, strategies of signification since there was greater agreement among members of this group. This

pointed to a greater mastery of the semantic dimension of language by more mature individuals. This may also indicate a cumulative growth in abilities, with older children having developed greater competence in behaviors they had exhibited earlier. It also suggested the molding influence of the school where certain ways of assigning meaning are learned through academic activity. Language arts activities in the school prepare the individual to examine word meaning in more complex ways as he progresses through school. Formal vocabulary development, as well as reading activities, bring students to develop certain standardized ways of defining words such as examining functional or generic relations. This effect was reflected in the dimensions of meaning identified for the two groups.

Results of the Kruskal-Wallis test (Table XIV) revealed that Grade V students chose the synonym, class-implied, intension, analysis, and extension categories more frequently while the Grade VIII subjects use part-part, repetition, association, connotation, and context categories more often. Since this statistic was simply a measure of the frequency of choice of categories rather than particular combination of choices only limited conclusions could be drawn from the results.

The data suggest that the older students had more depth and variety in word meaning due to the emotive (connotation and association) dimension present in their

semantic behavior. This appears contrary to previous findings (Burns, 1960; Feifel and Lorge, 1950) but in terms of the author's theoretical position this finding indicated the presence of more complex dimensions of meaning for individuals as a result of cumulative learning history. This conclusion was borne out in the fact that the younger subjects used the synonym and description type of definition more frequently. These are "dictionary" definitions and generally reflect little of the individual's experience with the concept.

The differences between the findings of the present study and those of Burns and of Feifel and Lorge may also be explained by noting the nature of the task set for the Ss. The present study required the Ss to select the more adequate semantic relation of the two presented at one time. Since twenty-four categories of meaning were used, there was much opportunity for variation in response. With studies such as those of Burns, Ss were required to give the single "correct" definition of a word resulting in greater dependence upon a synonym type of definition. There is inevitably less opportunity to show the range of one's experiences with a concept if only a single response is allowed. Also, as the individual matures, more associations will accrue to a concept thus a simple synonym definition will not suffice to express the totality of meaning. Finally, the dimensions identified in the present study were comprised of several categories and

the synonym category may be accompanied by various other kinds in a particular dimension. This "dimensional" approach to description of semantic competence was not used in the above studies.

Grade V subjects used the analysis and extension categories more frequently suggesting that these individuals were more concerned with the function of the concept and its degree of familiarity to them than were the older students. This implied a concrete, immediate kind of meaning for concepts. Apparently these children were not as concerned with the connotative aspects of meaning as were more mature individuals.

Grade VIII subjects employed the part-part and context categories with greater frequency indicating more concern for the kinds of relationships present. Their concern appeared to be for the logical relationships present among elements of the concept as well as for the semantic relationships present in an utterance.

Correlations of the Semantic Features Test With the California Test of Mental Maturity

Both the SF and CTMM are based on a factor theory of intellectual ability (see Chapter V). Thus, the degree of correlation between the two tests was considered important in revealing the nature of the behavior indexed by the SF test. While the SF test was designed as a measure of semantic competence, the CTMM was developed as

a means of measuring intellectual capacity postulated to be present in several primary factors. Essentially, therefore, the SF is a test of verbal ability while the CTMM comprises measures in spatial, logical and mathematical reasoning as well as verbal ability.

The first three subtests of the CTMM (opposites, similarities, and analogies) are non-verbal in nature and it is here that correlations were lowest. It was apparent from these results that an individual's verbal competence and his ability at a certain kind of logical reasoning, viz., the ability to perceive likenesses and differences are not closely related and that this non-verbal reasoning comes to be less related to verbal and symbolic functioning as the individual matures. Thus, only the verbal subtests of the CTMM, having the most consistent correlation with the SF test, appeared to index semantic competence. The low order of correlation indicated that the two tests measure different kinds of semantic performance.

This result may have important implications for language research. Studies of concept formation involving non-verbal stimuli, e.g., sorting objects, may be poor indicators of an individual's verbal conceptualizing ability. There appear to be two quite distinct types of intellectual competencies, one having to do with non-verbal logical operations, the other functioning upon and with linguistic symbols. It may be that either can develop

relatively independently of the other. This contention was borne out in the comparatively high correlations between the mathematics subtest of the CTMM, which is verbal in nature, and the SF test. Furthermore, the decrease in extent and degree of correlation between the SF and the CTMM Level 3 further supported the contention that certain verbal skills develop independently of other intellectual abilities. The development of a richer, more efficient semantic space for processing verbal data appeared not to be directly related to the development of one's spatial-practical thinking ability as measured by the CTMM.

The concept of factors in intelligence is held by psychologists generally. Two somewhat divergent traditions have developed on either side of the Atlantic. The multiple factor theory in America, as exemplified in Guilford's work, holds that "... intelligence has many aspects which can usefully be represented as Thurstone did, in terms of partially distinct though overlapping primary factors" (Vernon, p. 2)[1]. On the other hand the British factorists, with their hierarchical model, contend that:

> A general intelligence factor seems unavoidable since substantial positive intercorrelations are found when any cognitive tests are applied to a fairly representative population (Vernon, p. 2).

[1] Cf Vernon, P. E. Intelligence and attainment tests. London: University of London Press, 1960.

Studies have shown that despite differences in analytical techniques and interpretation of factors the two positions are basically in agreement. Bernyer (1958) has shown that the two approaches can yield almost identical results. In the hierarchical model:

> ... after removing the general [g] factor, the positive residual correlations always fall into two main groups -- the verbal educational (v:ed) group and the spatial-practical-mechanical group [K:m complex] (Vernon, p. 3).

These factors usually yield additional minor factors which can be further subdivided by additional testing.

Cattell (1963) has developed the notion of a hierarchical model of intelligence into a theory of fluid and crystallized intelligence. His notion of fluid and crystallized general abilities is similar to the two main group factors v:ed and k:m of the British school (see above). He contends that crystallized abilities are associated with those cognitive performances in which skilled judgment habits have become crystallized as a result of earlier learning application of some prior general ability to these fields (Cattell, 1963, pp. 2-3). This corresponds to the verbal educational group in the hierarchical model. Fluid ability on the other hand is associated with adaptations to new situations (Cattell, 1963, p. 3). This ability corresponds to the spatial-practical group factor. Cattell contends that crystallized abilities hinge on culture habits, they have "... a form determined by and representing history" (1963, p. 5).

Fluid abilities are more constant and biologically determined (Cattell, 1963, p. 3).

The notion of a culturally or experientially determined intellectual ability corresponds with views of writers such as Gagne (1968) [see Chapter II] and has important implications for the present study. The investigator postulated a semantic space comprised of a number of dimensions or ways of perceiving semantic relations. These dimensions were considered to be learned behaviors falling within the verbal-educational or crystallized factor of intelligence. This ability, therefore, should show qualitative changes with experience and learning and should be an important correlate of an individual's semantic competence.

Psychologically, the "g" is held to be the all-round level of our thinking skills; statistically it is the average of a battery of tests of intellectual factors so diverse that factors involved in separate tests cancel one another out (Vernon, p. 5). Writers such as Hebb (1948), Piaget (1950), Ferguson (1954), and Gagne (1968) point to the need to get away from intelligence as a definite entity which simply matures as children grow up. Rather they suggest it be thought of as the cumulative formation of more and more complex and flexible schemata (Piaget), phase sequences (Hebb) or rules (Gagne) which develop through interaction between the growing organism and its environment. Intelligence, then:

> ... refers to the totality of concepts and skills, the techniques or plans for coping with problems, which have crystallized out of the child's previous experience (Vernon, p. 5).

On the basis of the hierarchical model of intelligence the Semantic Features Test can be considered to provide a measure of the verbal educational factor within "g". The California Test of Mental Maturity attempts to index both the verbal-educational and the spatial-practical factors of intelligence. Correlations between these tests should be indicative of the nature of "g" for groups. Learning and growth appear to produce consistent effects upon "g". Psychometrists such as Garrett (1946) and Cattell (1963), are inclined to attribute the decreased prominence of "g" in older groups to the differentiation of abilities with age. Therefore, the Grade VIII Ss of the present study should show more diverse intellectual abilities comprising additional minor intelligence factors. This development should be revealed in decreased correlations among tests of intellectual functioning. Such an effect was seen in the decreased extent and degree of correlations of the SF and CTMM tests for the Grade VIII Ss as compared with the younger Grade V Ss. Vernon (p. 4) contends that similar results in other studies could often be held suspect since the older group was more selected and more homogeneous thus less representative of the total population. This was not the case in the present study since there was a negligible drop in school population from Grade V

to VIII and both treatment groups were randomly selected.

The results of the analysis of variance of scores for "idealized individuals" also showed that verbal and non-verbal skills were largely independent. The verbal comprehension subtest of the CTMM, which is a conventional synonym-type vocabulary test, was the only subtest capable of distinguishing among individuals operating at different levels of semantic competence. This result also pointed out a weakness in the conventional vocabulary test, i.e., its inability to describe the individual's level of competence in any but quantitative terms.

The ability of the CTMM to discriminate between idealized individuals identified by the SF test provided evidence of the construct validity of the SF test. The results of the correlations, provided additional evidence that the SF test was a valid measure of semantic ability. The correlations were seen to be somewhat higher and more extensive between the SF test and the language subtest of the CTMM than the non-language subtest of the same test.

Factor Analysis

> In factor analysis the "individual differences" represented by a large number of measures, that are given to a single population ... are studied to detect possible common sources of variation or variance ... factor analysis attempts to account statistically for differences in traits among individuals rather than for mental organization within any one individual (Fruchter, 1954, p. 3).

This statistical technique was most appropriate to the problem of this study, i.e., identifying the smallest number of common elements in the semantic behavior of individuals.

Nonmetric multidimensional scaling, used in this study, is a factor analytic procedure for data analysis. It operates on the assumption of an orthogonal factor structure, i.e., independent dimensions, by employing the Euclidian space model in its computations. In a complex area such as word meaning, the factors which define behavior may not be independent. Thus, the data of the present study were subjected to factor analysis with oblique rotation to test the validity of the Euclidian space concept as applied to semantic measures.

Although the data submitted to the principal-axes factor analysis were essentially an "average" of the data submitted to the multidimensional scaling program, taking the form of frequency of responses in categories rather than measures of dissimilarity (proportions), the resultant factors were highly similar to the dimensions obtained through scaling. Furthermore, the most adequate description of the behavior being measured could be made in five factors. This corresponded to the five dimensions identified by the scaling program.

The oblique rotation produced generally low-order correlations between primaries indicating a high level of independence of factors. This information was

considered sufficient justification for accepting the statistical procedures used in the multidimensional scaling program as satisfactory for the present study.

SUMMARY

In this chapter several kinds of analyses were reported. These analyses were carried out to investigate the reliability and validity of the experimental test, to examine its correlation with a standardized test of mental ability, and to investigate the suitability of the mathematical model underlying the multidimensional analysis.

The analysis of test characteristics revealed an acceptable level of reliability through the measure of internal consistency. The test's diagnostic potential was indicated in that the older group responded significantly more like an adult could be expected to perform. Ss were found to vary greatly, in their responses to items, within both groups pointing to the need for identifying groups within the sample population. Although the two groups used essentially the same standards in making choices on the test, several of the categories represented in the pairs of items were ranked significantly differently by these groups. These data pointed to different semantic spaces for the two groups of Ss and suggested the validity of this measurement technique.

Correlations between the Semantic Features Test and the California Test of Mental Maturity revealed a

greater correlation between Ss responses for Grade V than for Grade VIII. The SF test and the language section of the CTMM showed the greatest correlation. These results suggested that the individual's intellectual functioning can be represented by two factors, the verbal-educational factor and the spatial-practical factor. The SF and CTMM Tests both measure certain aspects of the verbal-educational factor but the SF test appears to index certain features of semantic competence not measured by the Language Subtest of the CTMM. For example, the older Ss appeared to have a more diverse verbal-educational factor than the younger Ss, a development revealed in the decreased number of correlations between the SF and CTMM Tests for Grade VIII Ss. The limited number of correlations between the SF and the non-language portion of the CTMM suggested the inappropriateness of studying verbal concept formation through non-verbal stimuli.

A principal-axes factor analysis of the data, conducted for purposes of verification, identified the same number of interpretable factors as dimensions identified by the multidimensional scaling program. Also, factors identified by the factor analytic program proved to be similar in composition to the dimensions in multi-dimensional scaling and since the latter program was more appropriate to the data it was used in the remainder of the analysis. The principal axes factor analysis also showed the correlations between primary factors to be of

a relatively low order confirming the appropriateness of the Euclidian Space Model used in the multidimensional scaling program.

CHAPTER VII

FINDINGS: SEMANTIC SPACE

This chapter presents the findings of the nonmetric multidimensional scaling procedure used in analysis of data from the Semantic Features Test. The main sections are: multidimensional scaling-group model and multidimensional scaling-individual differences model which identify the dimensions of semantic space for each of the two treatment groups and subgroups within them.

I. MULTIDIMENSIONAL SCALING - GROUP MODEL

Findings

The analysis central to this study involved nonmetric multidimensional scaling used to identify the dimensions underlying the subjects' responses. These dimensions were postulated to represent the dimensions of individuals' meaning space. To provide data for the multidimensional scaling program a proportion matrix was calculated giving the proportion of times each of the twenty-four categories was chosen over each other one. This matrix was subjected to a factoring procedure through the Kruskal-Shepard Multidimensional Scaling technique (Kruskal, 1964, a & b).

Table XXI and Appendix D show loadings on five dimensions of the final configuration of the

TABLE XXI

MULTIDIMENSIONAL SCALING - DIMENSION LOADINGS ON FINAL CONFIGURATION[a] FOR THE SEMANTIC FEATURES TEST GRADES V & VIII

VARIABLES	DIMENSION LOADINGS[b] Dimension I		II		III		IV		V	
	Grade 5	8	5	8	5	8	5	8	5	8
Synonym	.599			-.864						
Similarity	-.853	-.667						-.698		
Superordinate			-.855					-.716		
Coordinate							.583	.614	-.540	
Attribute							-.655	-.691	.604	
Contrast									-.724	-.729
Action-of	-.734	-.725								
Action-upon	.745					-.843				
Whole-part				.622	-.813					
Part-part		-.815			.752					
Common-use						.505	.733			-.565
Use-of								.606	.917	.618
Repetition					.691			-.715		
Contiguity							-.905			-.838
Association	.733	.792								
Connotation			.783	.749						
Analysis					.697	.903			-.638	
Synthesis							.929	.767		
Extension					-.653				.647	.872
Context			.758					.702		
Ostensive			-.848							.712
Generic		.851					-.740			
Class Implied			.819	.816						
Intension					.724	.742				

[a]Stress - Grade V = 0.185, Grade VIII - 0.183: Iterations - Grade V = 17, Grade VIII = 17

[b]Loadings on dimensions for both groups shown for ease of comparison
Only highest or equivalent loadings on dimensions are shown

multidimensional scaling procedure for Grades V and VIII. It was decided, on the basis of stress levels and the psychological nature of dimensions, that five dimensions meaningfully and adequately defined the measured meaning space of each group. Stress levels for Grades V and VIII were 0.185 and 0.183 respectively. Kruskal (1964a, p. 3) considers stress (goodness of fit) of 0.10 to 0.20 to be "fair." Klahr, in investigating the statistical significance of the results obtained from empirically based nonmetric multidimensional scaling, has set out some estimates of stress levels to "... be used as a bench mark against which to evaluate the significance of ... results" (Klahr, 1969). He has indicated that stress increases with increasing points or stimuli. His study can be interpreted to indicate that the stress levels for the five dimensions obtained in the present study would have a relative frequency of occurrence of approximately .10 by random fluctuation. Thus, the decision to use a configuration of five dimensions was considered appropriate to the nature of the problem and of acceptable statistical significance.

Table XXII presents the Ahmavaara Factor Match between the two groups.

These data gave evidence of a considerable degree of congruence in the structure of meaning space for the two groups, as expected. Considering the variables loading on dimensions for each grade group and the value

TABLE XXII

AHMAVAARA FACTOR MATCH
GRADE V - VIII COMPARISON MATRIX L
ON THE SEMANTIC FEATURES TEST

	1	2	3	4	5
1.	0.9403	-0.0071	-0.3358	-0.0123	0.0529
2.	-0.3019	0.5645	0.0919	0.4731	-0.5982
3.	-0.1144	0.0252	0.9428	-0.2003	0.2394
4.	0.0517	0.5943	-0.2616	0.7340	0.1920
5.	0.3687	-0.2071	0.2684	-0.2111	0.8394

TABLE XXIII

DIMENSION DESIGNATION
FOR THE MULTIDIMENSIONAL SCALING PROCEDURE
ON THE SEMANTIC FEATURES TEST GRADES V & VIII

Dimension Number	Grade V	Grade VIII
1	Similarity-Action	Example
2	Experience	Class Implied
3	Class-Relation	Class-Action
4	Association	Relation
5	Analysis-Function	Contiguity

of these loadings, the dimensions were identified as follows in Table XXIII.

The dimension patterns for each group (Table XXI) indicated a basically similar meaning space for the treatment groups. This was confirmed by the Factor Match Test (Table XXII). Also evident was qualitative change with increasing chronological age. Dimensions identified for the Grade VIII group included more of the class-type strategies of signification while those of the Grade V group were indicative of a greater dependence upon the experience of the subject and his relationships with the significate. The signs on variable loadings showed the dimensions to be bipolar. It suggested that although certain elements constitute a particular dimension of meaning, they exist in "clusters" at opposite directions on the plane of that dimension in meaning space. This characteristic of meaning dimensions may account for the breadth and depth of meaning of words under various contextual conditions. Subsequent sections examine this matter in detail.

Concerning the dimension patterns for each group, the stress level and number of iterations necessary to achieve the minimum stress level were similar in the two groups. Thus, it was decided that the meaning space of children in both treatment groups could be defined by the same number of dimensions.

Discussion

Examination of the dimension configuration revealed that five dimensions most satisfactorily defined meaning space for the subjects. This result was as expected since the composition of the test was in five major logical groups comprising the twenty-four categories of meaning. These groups included the following types of definitions: similarity, relation, action, explanation, and class membership.

Labelling of dimensions was done with considerable tentativeness considering in each case the loading of meaning categories on dimensions as well as the inherent psychological processes. Dimension patterns (Table XXI) indicated a substantial change in meaning space from the younger group to the older one, bearing out results of the findings in Chapter VI. Since the analysis being reported in this section involved the total experimental group, individual differences were depressed producing a somewhat similar sort of meaning space for both groups. The Individual Differences Model (Tucker and Messick, 1963), discussed later, brings out these differences within the total group to a greater extent.

A qualitative change was evident in the subjects' behavior. The younger children appeared to be more dependent upon personal experience and the function of the concept, their meaning dimensions showing somewhat higher loadings in categories such as similarity and

contiguity (see Table XXI). The older children, on the other hand, have moved nearer a class-type of strategy of ascribing meaning to concepts shown by the higher loadings on categories such as generic and part-part. The same variables were present in the dimensions of both groups; it was the manner and degree to which they loaded on these dimensions that indicated the nature of the final configuration.

The bipolar nature of dimensions with categories clustering at opposite ends of the plane of the dimension as evidenced by signs in the final configuration appeared to make possible almost infinite variations in dimensions. This characteristic of dimensions may make possible the selection of appropriate meaning as dictated by contextual conditions. As Salomon (1966) contends:

> ... context embraces more than merely the surrounding words and the manner of their utterance: in the last analysis it comprises the entire state of affairs at the time and the place of utterance and all that has led up to it -- at any rate, the cumulative consciousness of the state of affairs on the part of whoever is interpreting the meaning of symbols used (p. 50).

Word meaning must, therefore, be capable of wide variation and the bipolarity of the five dimensions defining meaning space for the Ss provided for this kind of change. A concept could presumably be located anywhere along the continuum constituting a dimension of meaning. Therefore, depending upon the categories at the poles and the position of a concept between the poles, the concept would take on different "meanings."

The bipolar view of semantic behavior has been proposed previously by other researchers. Osgood (1957) makes the assumption that there is some finite number of representational mediation reactions available to the organism and that the number of these alternative reactions (excitatory or inhibitory) corresponds to the number of dimensions in semantic space. He suggests that the location of a concept with reference to a dimension might be considered in terms of which of the two alternative reactions is elicited and the intensity (habit strength) of the reaction. Thus, for example, the concept bird may elicit a meaning located largely towards the similarity end of a dimension under certain conditions and towards the synonym end under other conditions if these two categories should occupy opposite poles on a dimension (other examples are included below).

Dimensions identified by the Multidimensional Scaling Program were interpreted on the basis of psychological behaviors inferred from the statistical data. Therefore, considerable experimenter interpretation of these data occurred based upon knowledge of the test items, children's semantic behavior, and the operation of the Multidimensional Scaling Program. In comparing dimensions of meaning, the final configuration was considered a more reliable indicator of the comparability of these structures than was the statistical measure of congruence, the Ahmavaara Factor Match. This was due to the greater

psychological vs. mathematical importance of certain elements (categories of meaning) within the final configuration for dimensions. The Ahmavaara Test was used largely for providing an estimate of congruence.

Dimension I. The data of the Ahmavaara Factor Match show that Dimension I correlated quite highly in the two groups. These dimensions are presented graphically in Figure 6.

Similarity-Action (Grade V) examined the manner in which a concept is like another as well as its active role on the one pole of the dimension. This was shown by the loadings on the categories similarity (-), e.g., small - tiny and action-of (-), e.g., dog - bark. The other pole of this dimension expressed the idea of synonymity or replacement along with the actions performed upon the concept in the high loadings on synonym (+), e.g., big - large, association (+), e.g., carry - heavy, and action-upon (+), e.g., throw - ball.

The Grade VIII dimension, Example, stressed the idea of the constituents or examples of a concept including its part-part relationship as well as its actions on the one pole with loadings on the categories similarity (-), e.g., good - better, part-part (-), e.g., door - window, and action-of (-), e.g., horse - gallop. The obverse pole identified the membership of the concept in its larger (generic) setting through high loadings on generic (+), e.g., scorch - burn, and association (+), e.g., enjoy - fun.

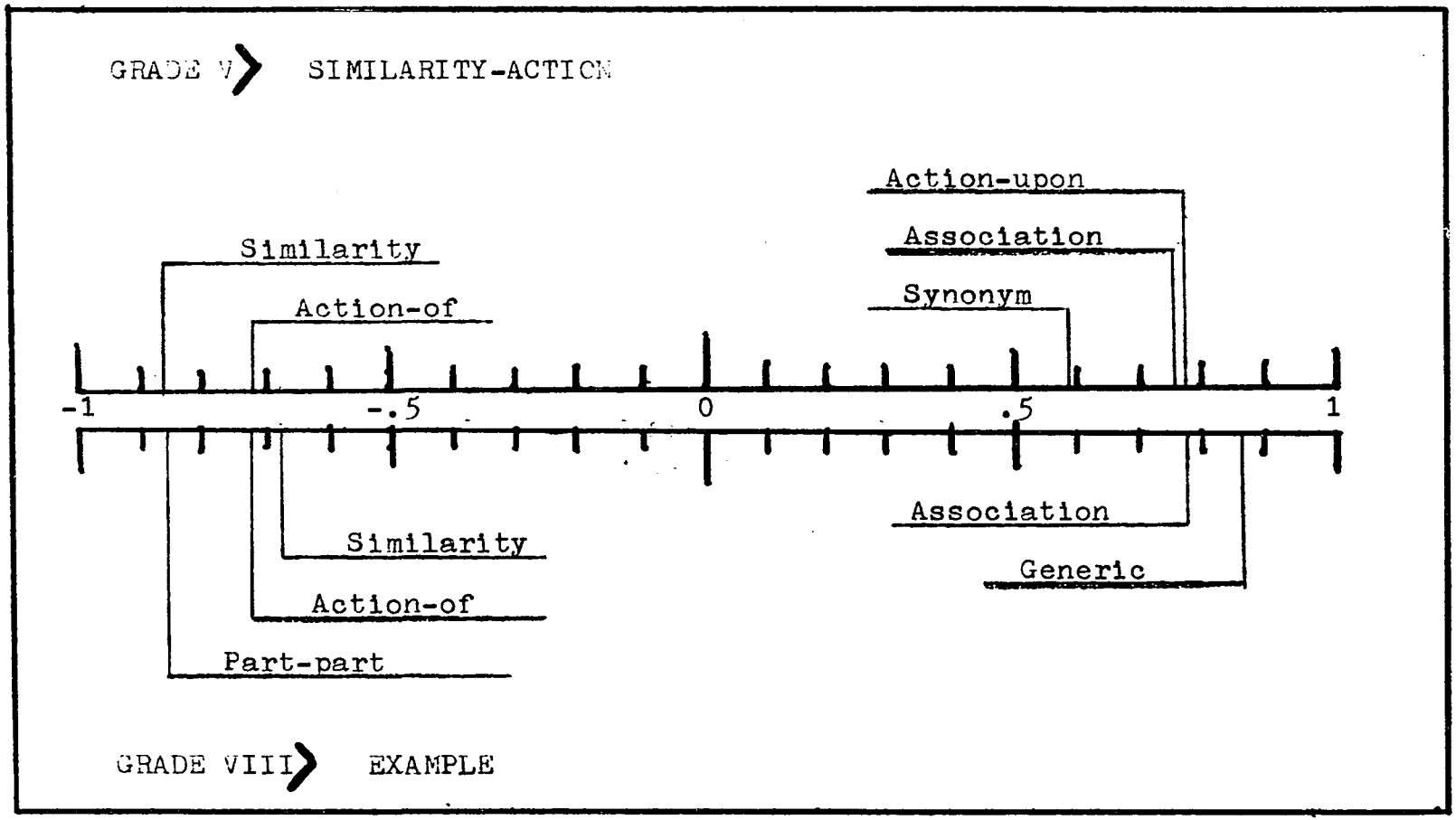


Fig. 6 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION I
GRADE V - GRADE VIII

The difference between groups on this dimension, as with the remaining four, was in the direction of a more complex meaning space for the older children. The Grade VIII children have begun to look at not only the way in which stimuli are alike as in the similarity category which they share with the younger Ss, e.g., small - tiny, smile - laugh, and their actions, e.g., dog - bark, hockey-player - skate, but also how referents fit into a broader frame of reference (the generic category), e.g., cup - dinnerware, noodle - food. This latter category was not present in this dimension for the younger Ss. The bipolar nature of this dimension would permit a greater or a lesser degree of identification of the concept in class terms for the Grade VIII group as the position of the concept moves from the generic pole to the similarity pole. For Grade V Ss the range would be between synonymity and similarity.

Dimension II. The second dimension showed the least congruence between groups on the Ahmavaara Match. These dimensions are presented graphically in Figure 7. In Grade V the Experience dimension appeared to define a concrete personal approach to the meaning of verbal concepts. Loadings on the one pole, ostensive (-), e.g., unfasten - you undo something, and superordinate (-), e.g., bird - sparrow, indicated the role of different kinds of experience in assigning meaning. Categories loading on the opposite pole, class implied (+), e.g.,

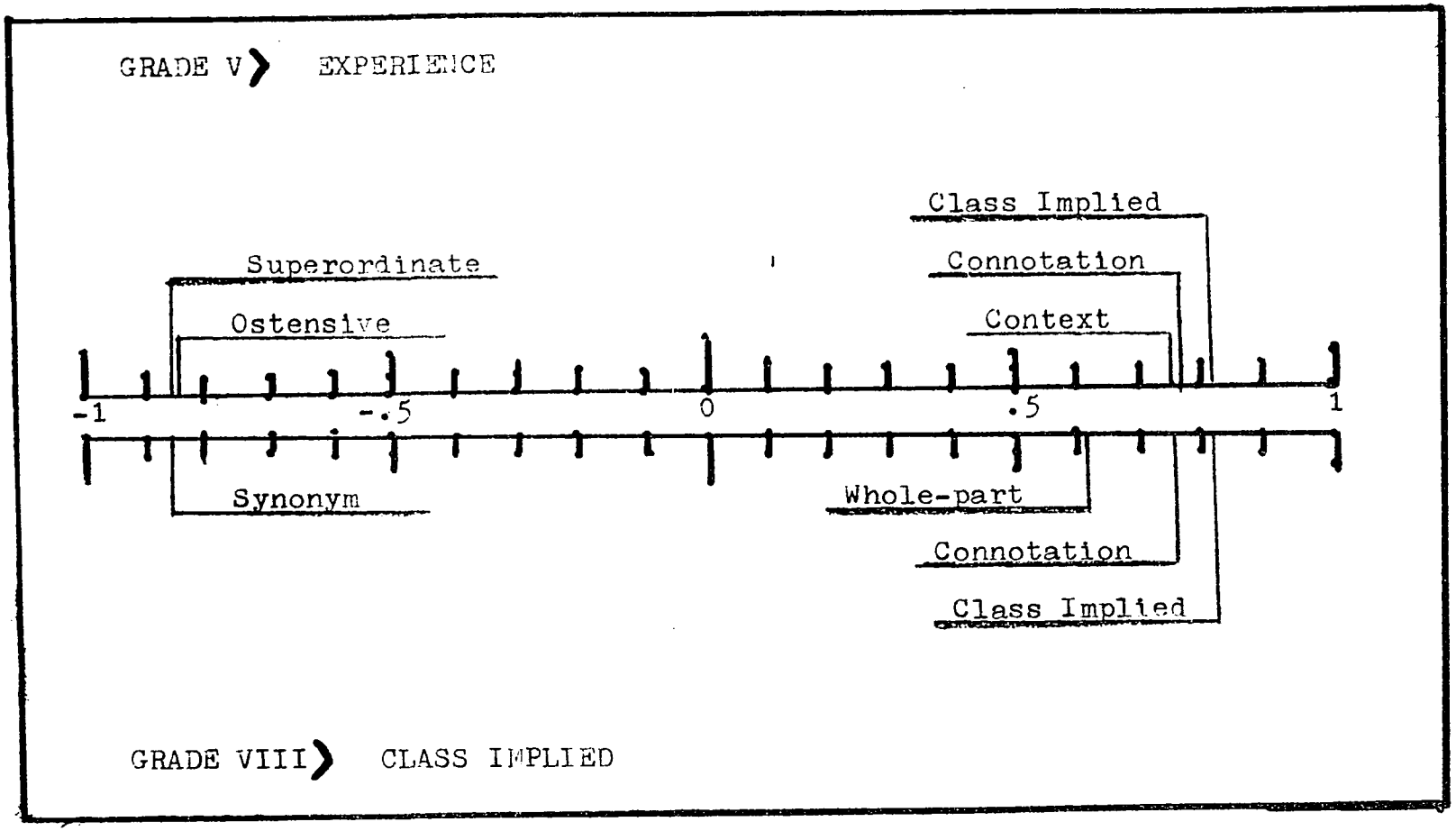


Fig. 7 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION II
GRADE V - GRADE VIII

stool - like a chair, context (+), e.g., shiver - shake and shiver in the cold, and connotation (+), e.g., royal - strong, showed the importance of contextual and other relationships of concepts.

The Grade VIII dimension Class Implied was a well developed component of these children's meaning space showing good logical and psychological composition. The categories appeared to belong together and clustered logically at the two poles. A synonym view of meaning occupied one end of the dimension with loadings on the synonym category, e.g., big - large. The other pole of this dimension consisted of class-type categories class-implied, e.g., cone - like an ice-cream cone, and whole-part, e.g., bird - wing, as well as the connotation category, e.g., modern - good.

In both groups the high loading on connotation suggested the considerable influence of the child's emotive response to concepts in the development of meaning. The grade VIII dimension showed more maturity in its consistency and logical economy. In Grade V, the bipolarity of this dimension could permit variations in meaning ranging from a greater reliance upon personal experience to contextual kinds of influences. The Grade VIII dimension provided for a range between synonym and a kind of incipient class definition.

Dimension III. The Ahmavaara Match showed considerable congruence between groups on this dimension.

Figure 8 presents this dimension graphically. Class-Relation in Grade V defined a type of class dimension. Loadings on the one pole whole-part (-), e.g., hand - finger, and extension (-), e.g., bugs - insects and flies, illustrated relationships between and within concepts. Categories loading on the opposite pole: part-part, e.g., wall - floor, repetition, e.g., drink - a drink of water, analysis, e.g., rule - to control people, and intension, e.g., advice - helpful information, showed a confounding of relation-type categories with a strictly class-type category (intension). This result suggested the inability of Grade V children to classify consistently.

In Grade VIII, Class-Action was another class-type dimension with an added action component illustrating the continued importance of action or the function of concepts. An action view of meaning occupied one end of the dimension with loading on the action-upon category, e.g., play - piano. The other pole of the dimension consisted of categories showing the association between word and referent as well as the class-type of definition. These were: analysis, e.g., lengthen - make a thing longer, common-use, e.g., farmer - tractor, and intension, e.g., alphabet - set of letters.

Again the older Ss possessed a more economical strategy for ascribing meaning to concepts since they did not include as many relational categories on the class membership end of the dimension. The older Ss also

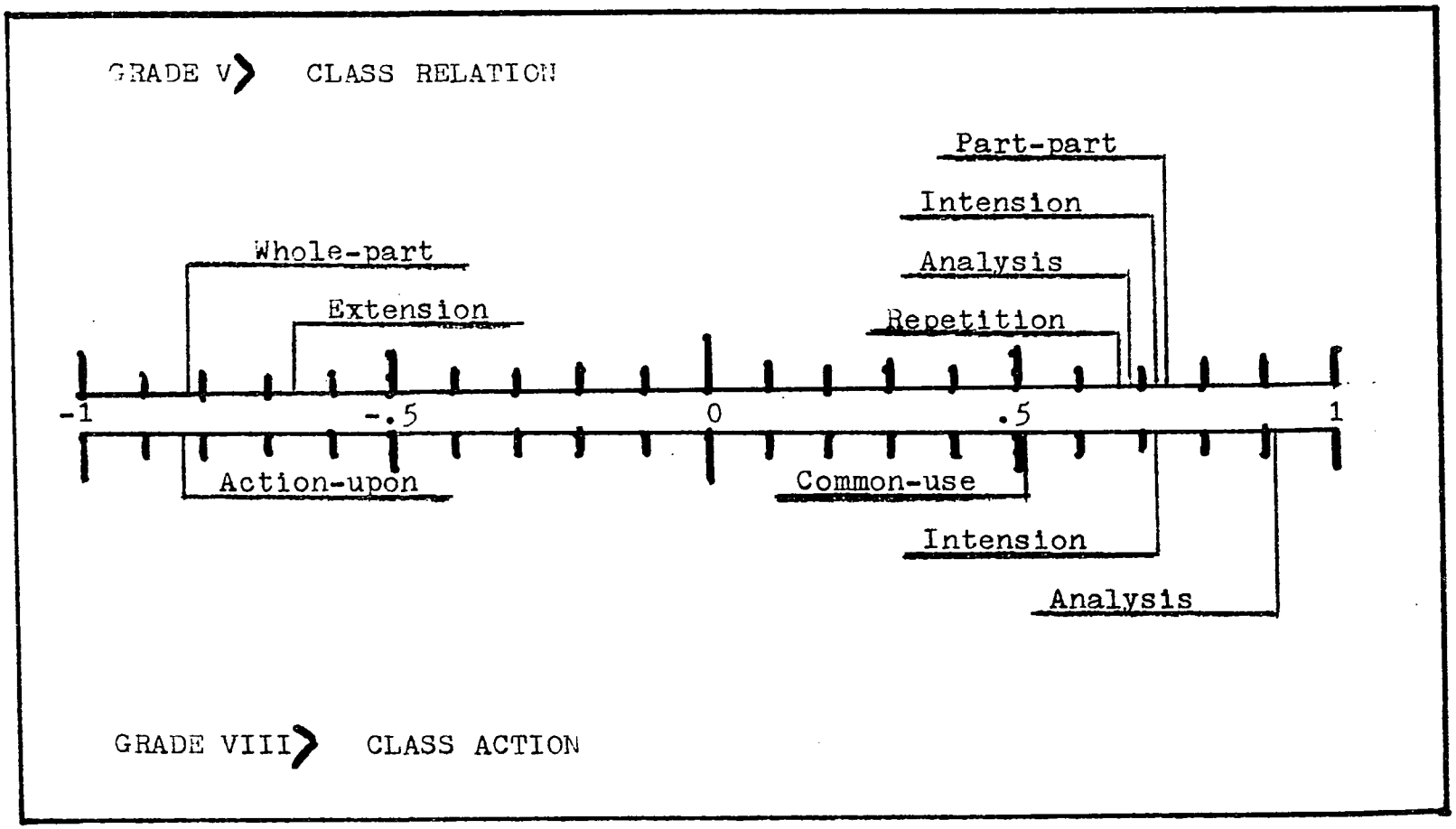


Fig. 8 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION III
GRADE V - GRADE VIII

showed a logical dichotomy in polarity on this category between the action of a concept and its class membership while the younger Ss showed no such logical dichotomy. The Grade V dimension thus permitted a more limited variation in meaning ranging from relation to class membership while the Grade VIII dimension provided for a range from action to class membership.

Dimension IV. Congruence between groups on this dimension was second lowest on the Ahmavaara Test. Figure 9 presents this dimension graphically. In Grade V Association exhibited the usual bipolarity by having two different sets of relation-type categories on opposite poles. The one pole showed loadings on attribute (-), e.g., lemon - sour, contiguity (-), apple - grows on a tree, and generic (-), e.g., water - liquid. The other loaded on coordinate (+), e.g., beets - peas, common-use (+), e.g., student - pencil and synthesis (+), e.g., bunk - it has two levels. These categories all define some kind of association between and within concepts.

The Grade VIII dimension, Relation, defined a similar type of behavior but with emphasis on a more logical relationship between verbal symbols and referents. The one pole, showing the nature of the relationship between symbol and referent, had loadings on similarity (-), e.g., good - better, superordinate (-), e.g., planet - Mars, attribute (-), e.g., mountain - immovable, and repetition (-), e.g., ring - ring the bell. The

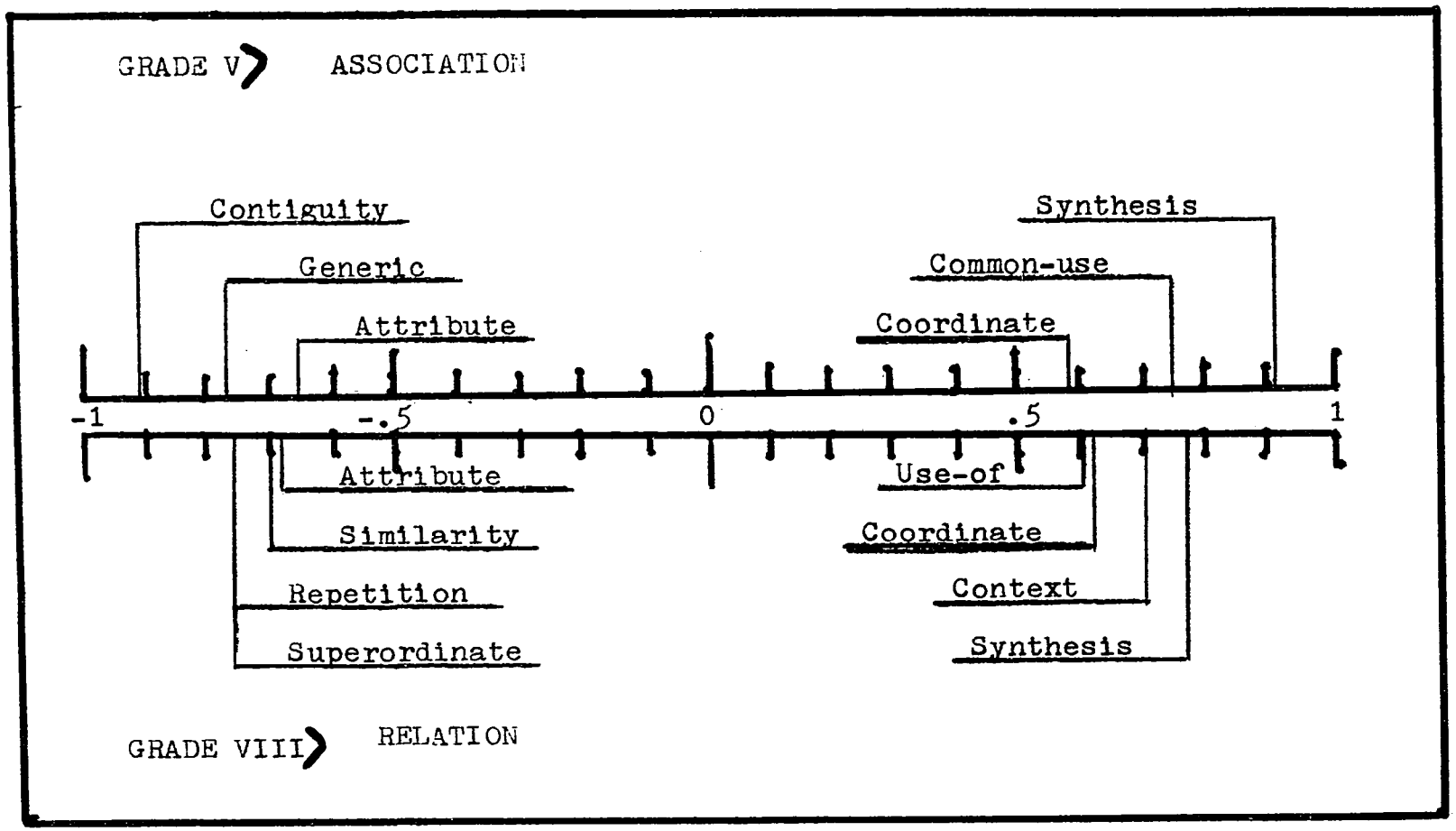


Fig. 9 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION IV
GRADE V - GRADE VIII

second pole, with emphasis on the kind of relations between associated concepts had loadings on coordinate (+), e.g., pencil - pen, use-of (+), e.g., scissors - for cutting, synthesis (+), e.g., musician - he has an instrument, and context (+), forward - moving forward he advanced.

Dimension IV in both groups was adequate from both a logical and psychological perspective and the difference between them suggested the influence of experience and learning upon the older students. This was evidenced by the manner of organization of the Grade VIII dimension where one pole appeared to show concern for the relation between word and referent, e.g., similarity. The other pole emphasized association among conponents of the concept named, e.g., context, forward - moving forward he advanced, as well as functional relations as in use-of. The Grade V dimension appeared to be more limited in examining the relations among concepts, e.g., there was no context category in this dimension. Both dimensions permitted a variation in meaning from that of simple association to the more complex relation among components of the concept as in context where the relation between the concept named and other concepts was examined.

Dimension V. The two groups exhibited considerable divergence on this dimension according to the Ahmavaara Test. This dimension is presented graphically in Figure 10. In Grade V Analysis-Function defined a dimension

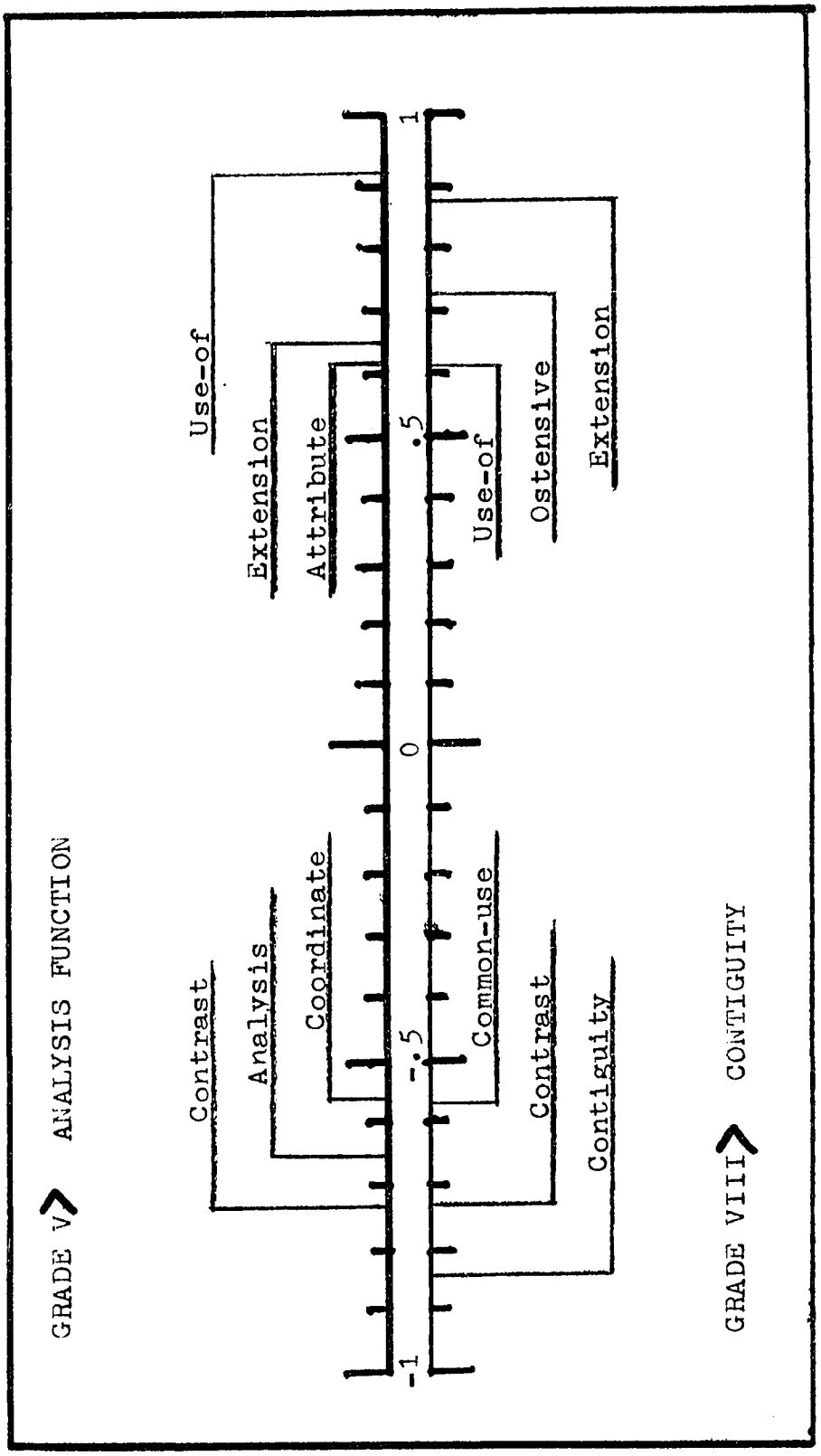


Fig. 10 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION V
GRADE V - GRADE VIII

showing the children's dependence upon functional relationships of concepts. The one pole appeared to index the relationships between word and referent with loadings on coordinate (-), e.g., comma - period, contrast (-), e.g., hard - easy, and analysis (-), e.g., practice - do again and again. These categories are alike in that there is some specific kind of relation between the word and that which defines it, e.g., equality, contrast, and function. The other pole showed loadings on categories which appeared to examine certain characteristics of the referent. These were: attribute (+), e.g., flame - hot, use-of (+), e.g., camera - for taking pictures, and extension (+), e.g., furniture - chairs or tables. These categories analyze the referent in terms of its attributes, purpose, and function.

The Grade VIII dimension Contiguity showed the children's dependence upon direct interaction with the referent. The one pole identified the quality of interaction of symbol and referent with loadings on contiguity (-), e.g., comma - placed in a sentence, common-use (-), e.g., doctor - drug, and contrast (-), e.g., later - earlier. These categories all identify some interaction of word and referent such as interaction of time, place, and activity or direction of relationship. The second pole appeared to index the quality of the individual's experience with the referent. High loadings occurred on: extension (+), e.g., skeleton - bones and skull,

ostensive (+), e.g., brave - when you show courage, and use-of (+), e.g., bank - for saving money.

Dimension V in both groups appeared quite adequate psychologically although basic differences were evident. The older Ss, while exhibiting essentially the same kind of psychological behavior as the younger Ss showed greater economy of effort. The Grade VIII dimension, as well as emphasizing personal interaction, showed evidence of a class-type of organization with loadings on ostensive and extension categories. On the other hand, the Grade V dimension emphasized the components of a concept along with its function without the attempt at organization seen in this dimension for the older group. As in other dimensions there was a range in meaning possible on this dimension in both groups ranging from analysis of the components of the concept to its function in Grade V and from the relation between symbol and referent to personal interaction in Grade VIII.

Summary

In general, dimensions identified for the Grade VIII group included more of the superior class-type strategies of signification while those of the Grade V group indicated a greater dependence of these Ss upon experience to produce meaning (Fig. 11). Dimensions of the younger Ss were generally not as logically sound and consistent as those of the older Ss. This suggested that

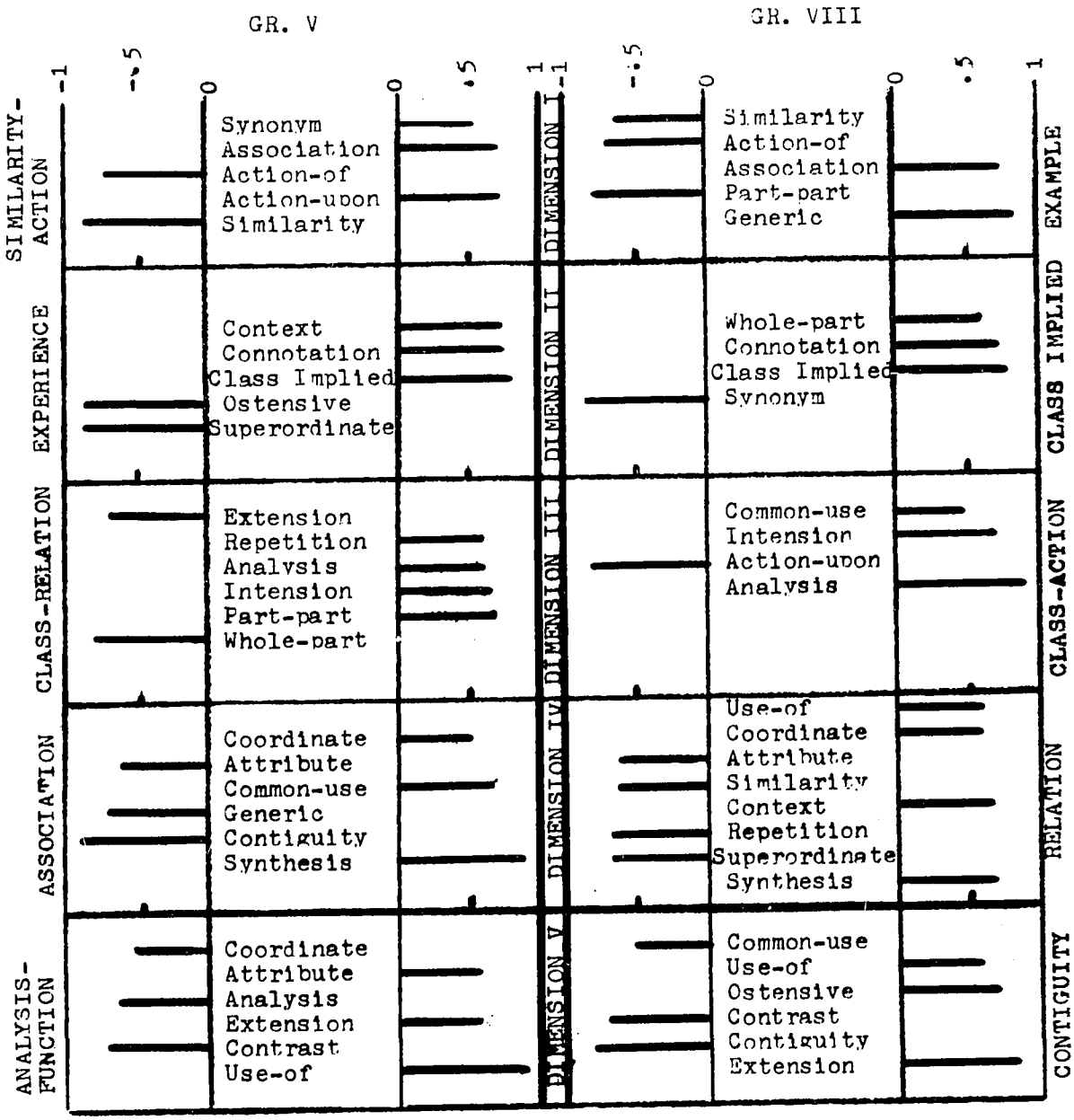


Fig. 11 SEMANTIC FEATURES TEST DIMENSION LOADINGS GR. V - GR. VIII

the Grade V group did not organize meaning strategies as logically as Grade VIII.

Specifically, Dimension I should allow the older Ss to look at the way in which the stimuli are alike and how they function as well as placing these stimuli within more inclusive categories, i.e., identifying their generic relationships. The younger Ss, on the other hand, appeared to consider only the similarity of events as well as their actions in this dimension.

Dimension II suggested the influence of emotive response to concepts in the meaning space of both groups. However, the Grade VIII dimensions appeared to be logically more consistent in the categories which load on it, i.e., the categories appeared to belong together and had the same signs in the dimension pattern. These categories emphasized a class-type strategy while those of the Grade V group suggested an emphasis on experience.

Dimension III appeared to be a more economical strategy for the older Ss having fewer relational categories. The younger Ss again showed a less logical dichotomy between categories loading on this dimension with action and class-type categories having the same polarity. Both groups appealed generally to the sorts of relations previously established between concepts to identify new instances of concepts although the younger Ss depended more on action than did the older Ss.

Dimension IV was a psychologically adequate

dimension for both groups with the older Ss showing the influence of experience. The dimension sought to establish the relations among concepts with the older Ss looking for somewhat more complex relationships than the younger.

Dimension V was similar for both groups emphasizing personal interaction with concepts. However, the Grade VIII Ss appeared to be attempting a class-type of organization while the Grade V Ss only examined the components of concepts in their interaction with them. The bipolar nature of all dimensions appeared to allow for variation in meaning due to contextual constraints.

II. MULTIDIMENSIONAL SCALING - INDIVIDUAL DIFFERENCES MODEL

Rationale

It is a commonly accepted premise in psychological and educational research that individual differences exist between subjects. The individual differences model for multidimensional scaling is a quantitative system which provides "... for differential representations of perceptual structures for individuals having different viewpoints about stimulus interrelationships" (Tucker and Messick, 1963, p. 333).

In past attempts at stimulus scaling two major approaches have been employed. In the first method group averages are determined and generalized to the "average person" in that group. This technique, although common in practice, may lead to straightforward but possibly false

interpretations since the results for the average person may not describe accurately the consistent responses of individuals within the group. In the second procedure each person's results are enumerated individually. The drawbacks here include the extensiveness of observations along with difficulties present in comparing results for individuals and groups.

As was evident in the earlier section on multidimensional scaling involving the averaging of responses there are some difficulties in making comparisons between perceptual structures from groups presumably having different orientations to stimuli. A common finding has been that only subtle differences appear in these structures and that the main attributes of perceived spaces are essentially identical (Messick, 1956). It may be that substantial differences existed in individual "sets" but the scaling method blended them together in deriving the average structure for the group. Thus, a method for uncovering differential perceptual spaces that does not require prior sorting of individuals but would isolate any consistent individual viewpoints about stimulus differences would circumvent the above noted difficulties.

The Tucker-Messick Individual Differences Model combines two scaling models. In the one, the vector model, the multidimensional space represents the different viewpoints of judges of a specified stimulus attribute. In the other, the distance model, the multidimensional space

represents the ways in which stimuli are perceived to vary where each judge perceives the space in a similar manner (Tucker and Messick, 1963, p. 336). Using this technique, a separate multidimensional representation of the perceived stimulus space is provided for each consistent viewpoint about stimulus similarity. Since there are presumably fewer consistent viewpoints than there are individuals, the technique is more efficient than analyzing each individual's structure separately. Also, this method provides a framework for comparing various viewpoints and relating them to external variables.

Selection of representative individuals.

The Tucker-Messick technique identified ten idealized individuals, five in each experimental group. The experimenter decided that, in order to conserve space, comparison of two representative individuals from each group would be performed rather than the detailed discussion of all ten cases. In the event that the test were employed for diagnostic purposes, all individuals would be described. Individuals one and three in each grade were chosen for detailed examination since they appeared to have considerably different viewpoints.

(a) Idealized Individual #3 - Grades V and VIII Findings

Table XXIV and Appendix F show loadings on five dimensions of the final configuration of the multi-

TABLE XXIV

MULTIDIMENSIONAL SCALING - DIMENSION LOADINGS ON FINAL CONFIGURATION[a]
FOR INDIVIDUAL #3
ON THE SEMANTIC FEATURES TEST

VARIABLES	DIMENSION LOADINGS[b]									
	DIMENSION I		II		III		IV		V	
	GRADE 5	8	5	8	5	8	5	8	5	8
Synonym	.926			-.650						
Similarity		-.701	.801							
Superordinate	-.688									-.623
Coordinate		.677					.652			
Attribute					-.654	-.884				
Contrast						-.598			-.810	.564
Action-of	-.781									.549
Action-upon									-.777	.723
Whole-part							-.781			.626
Part-part		.705							-.715	
Common-use							.774			-.754
Use-of						.516			.851	.551
Repetition								.914		
Contiguity	-.623	-.671					-.711		.696	
Association		.970					.707			
Connotation				.728	-.873					
Analysis					.878	.927				
Synthesis						-.636	.699			
Extension			-.727							.823
Context								.823	.684	
Ostensive			-.955	.774						
Generic				-.774			-.538		.542	
Class Implied			.820	.685						
Intension					.745	.841				

[a]Stress - Grade V = 0.180, Grade VIII = 0.179; Iterations - Grade V = 22, Grade VIII = 16
[b]Loadings on dimensions for both individuals shown for ease of comparison
Only highest or equivalent loadings on dimensions are shown

dimensional scaling procedure for Idealized Individual #3 in each of Grades V and VIII. Stress levels in the Individual Differences Model were similar to those in the Group Model and were therefore considered adequate. Table XXV presents the Ahmavaara Factor Match between the two perceptual spaces.

Considering the configuration and loading of variables on dimensions, the latter have been designated as indicated in Table XXVI.

TABLE XXVI

DIMENSION DESIGNATION
FOR THE MULTIDIMENSIONAL SCALING PROCEDURE
ON THE SEMANTIC FEATURES TEST GRADES V & VIII, INDIVIDUAL #3

Dimension Number	Individual #3 Grade V	Grade VIII
1	Relation	Contiguity
2	Comparison	Class-Experience
3	Class-Function	Class
4	Analysis	Context
5	Experience	Class-Action

The dimension patterns for each individual (Table XXIV) indicated two quite dissimilar meaning spaces. This was confirmed by the Factor Match Test (Table XXV). As with the group model a qualitative change was evident. Dimensions identified for the Grade VIII individual showed greater complexity and adequacy than

TABLE XXV

AHMAVAARA FACTOR MATCH
GRADES V - VIII INDIVIDUAL #3
COMPARISON MATRIX L
ON THE SEMANTIC FEATURES TEST

	1	2	3	4	5
1.	0.7641	0.0183	0.3105	0.4497	0.3423
2.	0.2040	0.3588	0.5738	0.2105	-0.6753
3.	0.2226	-0.0954	0.8879	-0.1734	-0.3505
4.	-0.2054	0.5585	0.3710	0.6620	0.2646
5.	-0.2486	-0.4410	0.3446	0.6710	0.4181

those for the Grade V individual. The Grade VIII individual employed more class-type strategies while the Grade V individual appeared to be more dependent upon experience and association with the significate. The bipolar nature of meaning dimensions for both groups was once more evident. As in the group model, five dimensions were considered to represent most adequately the nature of meaning space for both individuals.

Discussion

Dimension I. Data from the Ahmavaara Factor Match show that Dimension I varied considerably between the individuals. This dimension is illustrated graphically in Figure 12. In Relation (Grade V) the emphasis was upon the relationships existing between symbol and significate. The synonym (+) or labelling category, e.g., equal - same, occupied one pole of the dimension while the categories identifying the specific relation of label to concept, i.e.: superordinate (-), e.g., direction - south, action-of (-), e.g., scientist - works in a laboratory, loaded on the other pole.

In Grade VIII, Contiguity emphasized relationships between concepts and experience with the referent. The association (+), e.g., enjoy - fun, part-part (+), e.g., foot - knee, and coordinate (+), e.g., red - green, categories on one pole appeared to define the individual's attempt to relate the concept to something known. On the other pole, the similarity (-), e.g., good - expert, and

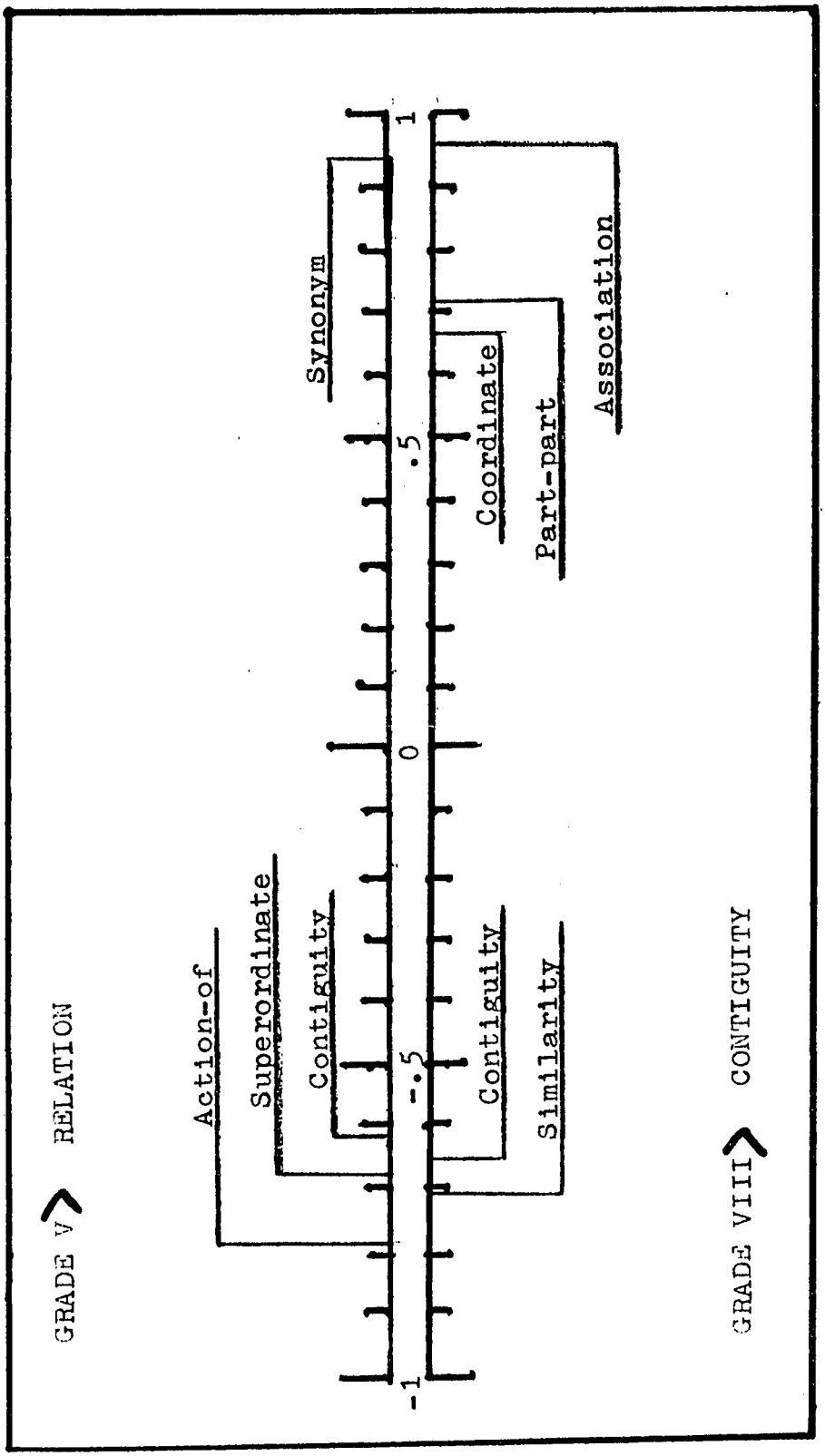


Fig. 12 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION I - INDIVIDUAL #3
GRADE V - GRADE VIII

contiguity (-), e.g., train - runs on rails, categories suggested the analysis of the relationships between concepts.

The difference in this dimension appeared to be in the direction of a more complex and analytical interpretation of meaning by the older individual. The Grade VIII "person" also exhibited a greater concern for experience with concepts since he looked for personal associations with the concepts identified by words. The younger individual, on the other hand, appeared to identify the concept by its label and the most apparent relations between word and referent. This dimension provided for variation in "meaning" of the concept ranging from naming to a specific kind of relation in Grade V and from analysis of the concept to its association with similar experiences for the Grade VIII individual.

Dimension II. The second dimension showed the least congruence between grades on the Ahmavaara Match. In fact, Dimension II in Grade V and V in Grade VIII were more highly congruent than Dimension II for Grade V and Grade VIII. Figure 13 illustrates this dimension graphically. In Grade V the Comparison dimension appeared to define a highly personalized approach to meaning. The categories loading on this dimension all suggested a degree of familiarity with the concept or a knowledge of concepts similar to the one being considered. Loadings on the one pole, similarity (+), e.g., well - perfectly,

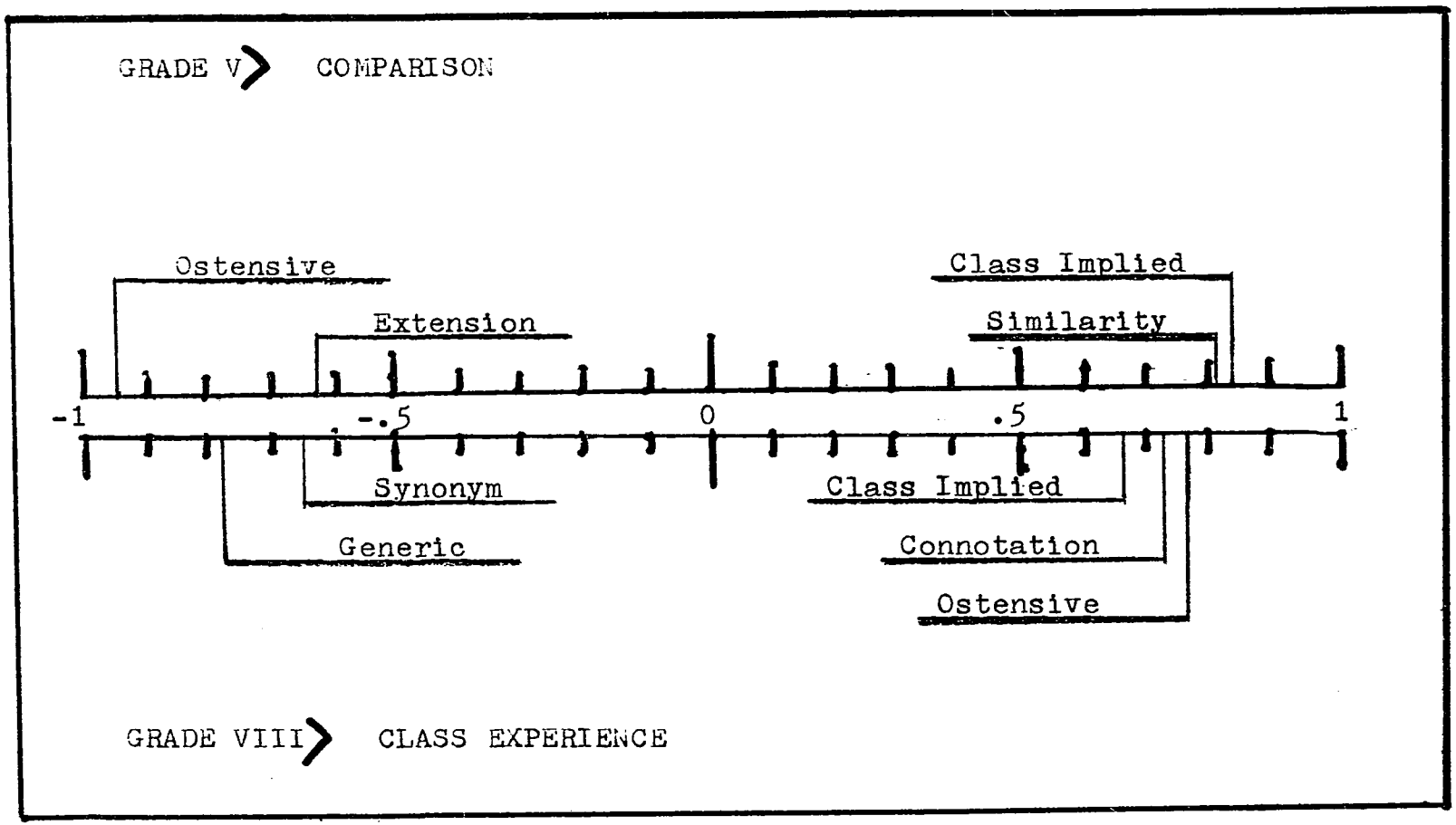


Fig. 13 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION II - INDIVIDUAL #3
GRADE V - GRADE VIII

and class implied (+), e.g., globe - like a ball, indicated the individual's attempt to compare the concept with something known. Categories loading on the other pole, extension (-), e.g., community - people and homes, and ostensive (-), e.g., sign - you write your name, showed an appeal to the individual's familiarity with the concept.

The Grade VIII dimension Class-Experience was a well developed component of meaning space for these children showing good psychological organization. A class-type of meaning occupied one end of the dimension with loadings of generic (-), e.g., submarine - ship, and synonym (-), e.g., usual - regular. The other pole of this dimension consisted of categories emphasizing experience with the concept. Loadings occurred on ostensive (+), e.g., frequently - you do it often, class implied (+), e.g., liquid - like water, and connotation (+), e.g., certain - good.

The Grade VIII dimension showed a better psychological composition and suggested the greater ability of the older Ss to set their experiences within a broader class-type of organization. In Grade V the bipolarity of this dimension would permit variation in meaning ranging from the similarity of one concept with another to the individual's familiarity with it. The Grade VIII dimension showed a range from class membership of the concept to the individual's experience with it.

Dimension III. The Ahmavaara Factor Match showed considerable congruence between individuals on this dimension. This dimension is illustrated in Figure 14. Class-Function in Grade V defined one variety of the class-type of definition. Loadings on the one pole, attribute (-), e.g., diamonds - expensive, and connotation (-), e.g., great - strong, illustrated certain characteristics of the concept largely based on the individual's experience with it. Categories loading on the opposite pole: analysis (+), e.g., openly - do in plain sight and intension (+), e.g., album - book for pictures, showed class membership of concepts with an added function component (the analysis category) indicating the importance of action in meaning.

In Grade VIII, class was a powerful class-type dimension. An attribute view of meaning occupied one end of the dimension with loadings on attribute (-), e.g., whale - large, contrast (-), e.g., serious - funny, and synthesis (-), e.g., fuel - it burns in a stove. These illustrated some characteristics of the concept. The other pole of the dimension consisted of class and class-type categories. These were: intension (+), e.g., brand - special mark, analysis (+), e.g., invent - develop something new, and use-of (+), e.g., magnet - for picking up iron.

Again the older Ss had a psychologically more adequate combination of categories in this dimension. The Grade V individual looked at concepts in class terms as

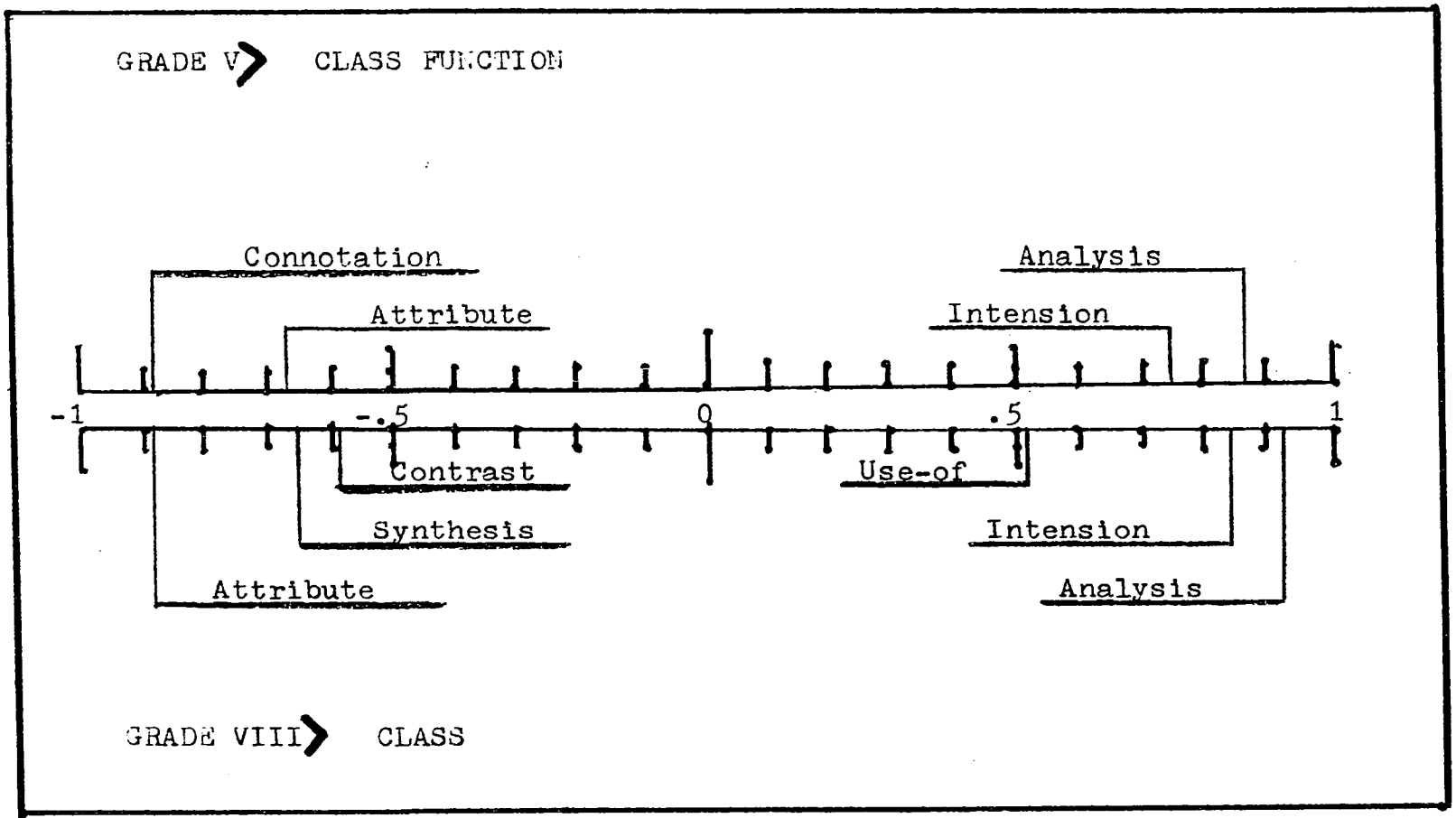


Fig. 14 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION III - INDIVIDUAL #3
GRADE V - GRADE VIII

did the Grade VIII individual but the latter appeared to examine concepts in a more complete and logical manner by including a greater variety of characteristics of these concepts. Thus the Grade V dimension appeared to permit a more restricted range in meaning going from the individual's experience with the function of the concept to its class membership. The Grade VIII dimensions, on the other hand, permits variation ranging from the characteristics of concepts to their class membership.

Dimension IV. The Ahmavaara Test showed a relatively low congruence between individuals on this dimension. This dimension is illustrated in Figure 15. In Grade V Association exhibited an approach to meaning through the analysis of the concept in terms of its components and its relations to other concepts. The one pole showed loadings on whole-part (-), e.g., flashlight - battery, contiguity (-), e.g., dock - where ship ties up, and generic (-), e.g., grizzly - bear. This suggested the individual's examination of the elements within and relations between concepts. The other pole loaded on coordinate (+), e.g., lantern - flashlight, common-use (+), e.g., sailor - ship, association (+), e.g., belong - yours, and synthesis (+), e.g., grain - from fields and crops. These categories indicated an attempt to associate concepts.

The Grade VIII dimension, Context, was very narrow having substantial loadings on only one pole. These were: context (+), e.g., support - it can support the weight,

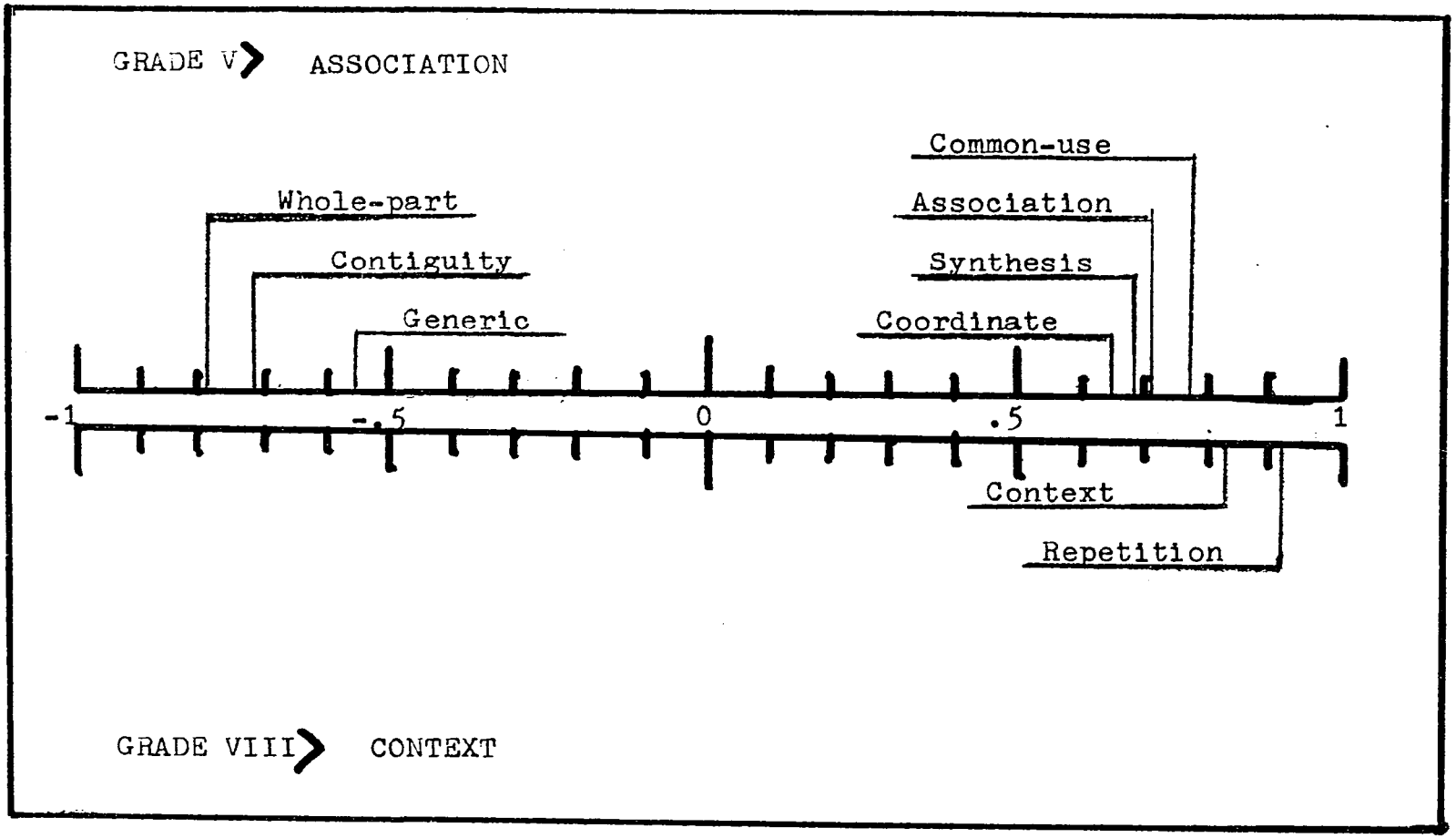


Fig. 15 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION IV - INDIVIDUAL #3
GRADE V - GRADE VIII

and repetition (+), e.g., assemble - assemble the parts. This dimension examined contextual relations between concepts.

Dimension IV for the two individuals differed in terms of its width or inclusiveness as well as the logic of its composition. The Grade V dimension was broader allowing for a range in meaning from an examination of the components of a concept to the relations between concepts. Nevertheless, the loadings of categories on the two poles showed a degree of inconsistency on the part of this individual since the two kinds of categories (component and relation) were found together. The Grade VIII dimension, even though very narrow, showed the ability of the older individual to bring about an economical and consistent organization of meaning dimensions. This result may be due to the child's educational experience where he learns to examine context for meaning. Also, cumulative learning (Gagne) and development of intellectual processes or schemata (Piaget) may account for this behavior.

Dimension V. The two individuals exhibited considerable divergence on this dimension according to the Ahmavaara Test. This dimension is illustrated in Figure 16. In Grade V Contiguity defined a dimension showing the child's dependence upon experience and knowledge of interaction among concepts. The one pole appeared to index the individual's experience with the functional and

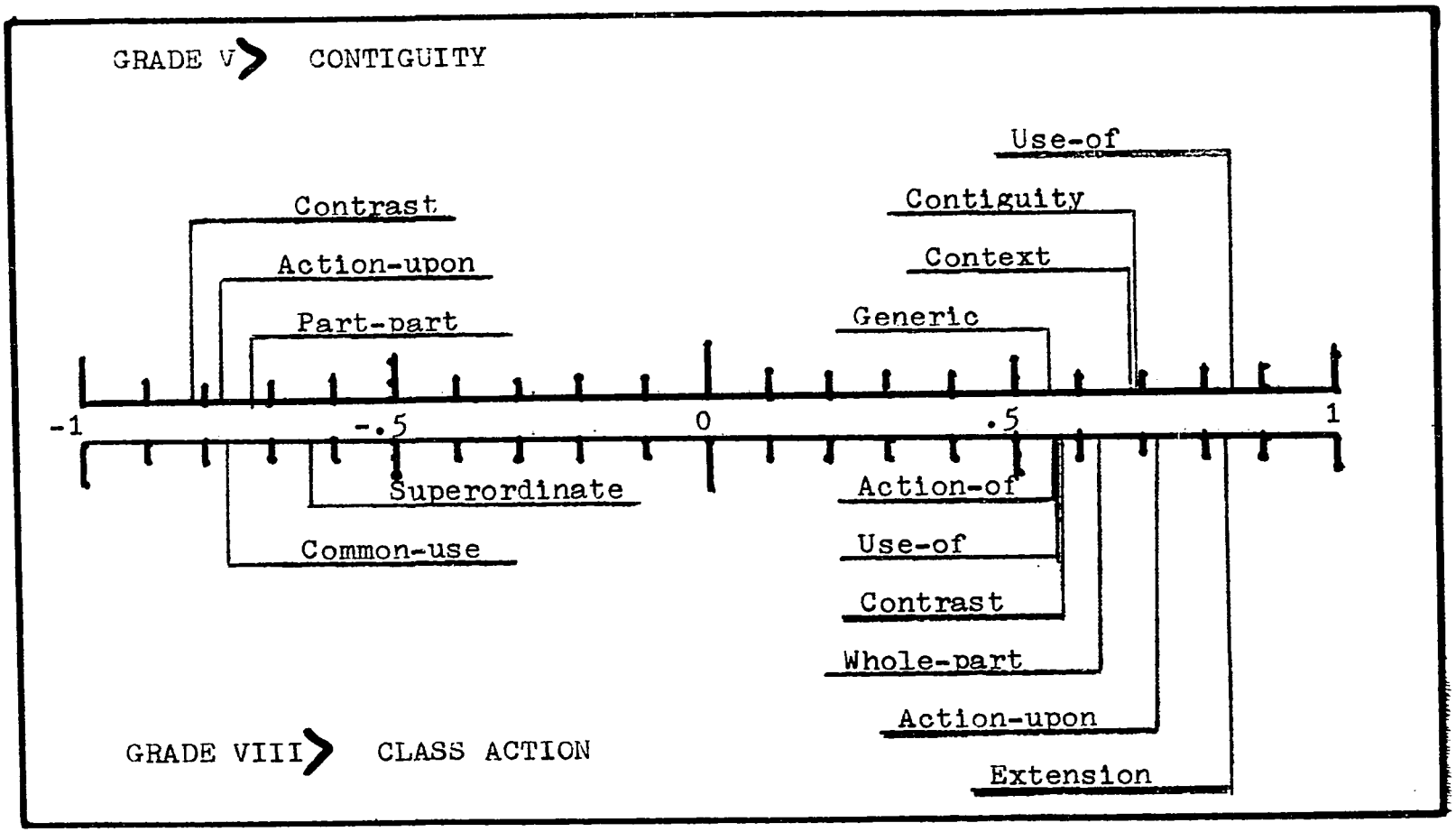


Fig. 16 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING DIMENSION LOADINGS - DIMENSION V - INDIVIDUAL #3 GRADE V - GRADE VIII

action relations between concepts, having loadings on contrast (-), e.g., silently - noisily, part-part (-), e.g., collar - sleeve, and action-upon (-), e.g., wear - blouse. The other pole showed loadings on categories which appeared to examine the interaction or contiguous relations between concepts as well as their classification. These were: use-of (+), e.g., spool - for winding thread on, contiguity (+), e.g., iceberg - floats in the ocean, ostensive (+), e.g., gladly - you do something because you want to, and generic (+), e.g., oyster - shellfish. These categories examined the referent in terms of its interaction with other concepts such as that of function, place, and membership.

The Grade VIII dimension Class-Action identified an attempt by this individual to classify the concepts according to their function and action. The one pole attempted to classify the use of concepts with loadings on superordinate (-), e.g., human - boy, and common-use (-), e.g., teacher - chalk. The second pole appeared to index a similar behavior in respect to classification of the action of concepts. High loadings occurred on: action-of (+), e.g., lion - roar, action-upon (+), e.g., love - friends, contrast (+), e.g., hard - easy, use-of (+), e.g., blotter - for drying ink, and extension (+), e.g., appearance - face and clothing.

Both individuals showed a dependence upon experience in this dimension although the older individual

examined the action and function of concepts, a more mature way of ascribing meaning than just simply referring to experience generally. Both dimensions offered opportunities for variation in meaning. The Grade V dimension ranged from the function of concepts to their interactions while the Grade VIII dimension ranged from function to action of concepts.

Summary

Considering meaning space in total for Individual #3 in Grade V and Grade VIII qualitative differences similar in nature to those noted between the grade groups were observed (Fig. 17). Since the effects of averaging perceptual spaces within the grades was removed through the application of the individual differences model the dimensions of semantic space for the representative individual in the two grades differed considerably more than did dimensions for the grade groups. In general, the older idealized individual possessed a more logical and economical semantic space suggesting greater efficiency and accuracy in processing words.

Specifically, Dimension I should allow the Grade VIII individual to develop a more complex meaning for concepts by examining his experiences with and the relations among them while the Grade V individual would look to the most apparent relations between word and referent.

Dimension II showed a better psychological composition

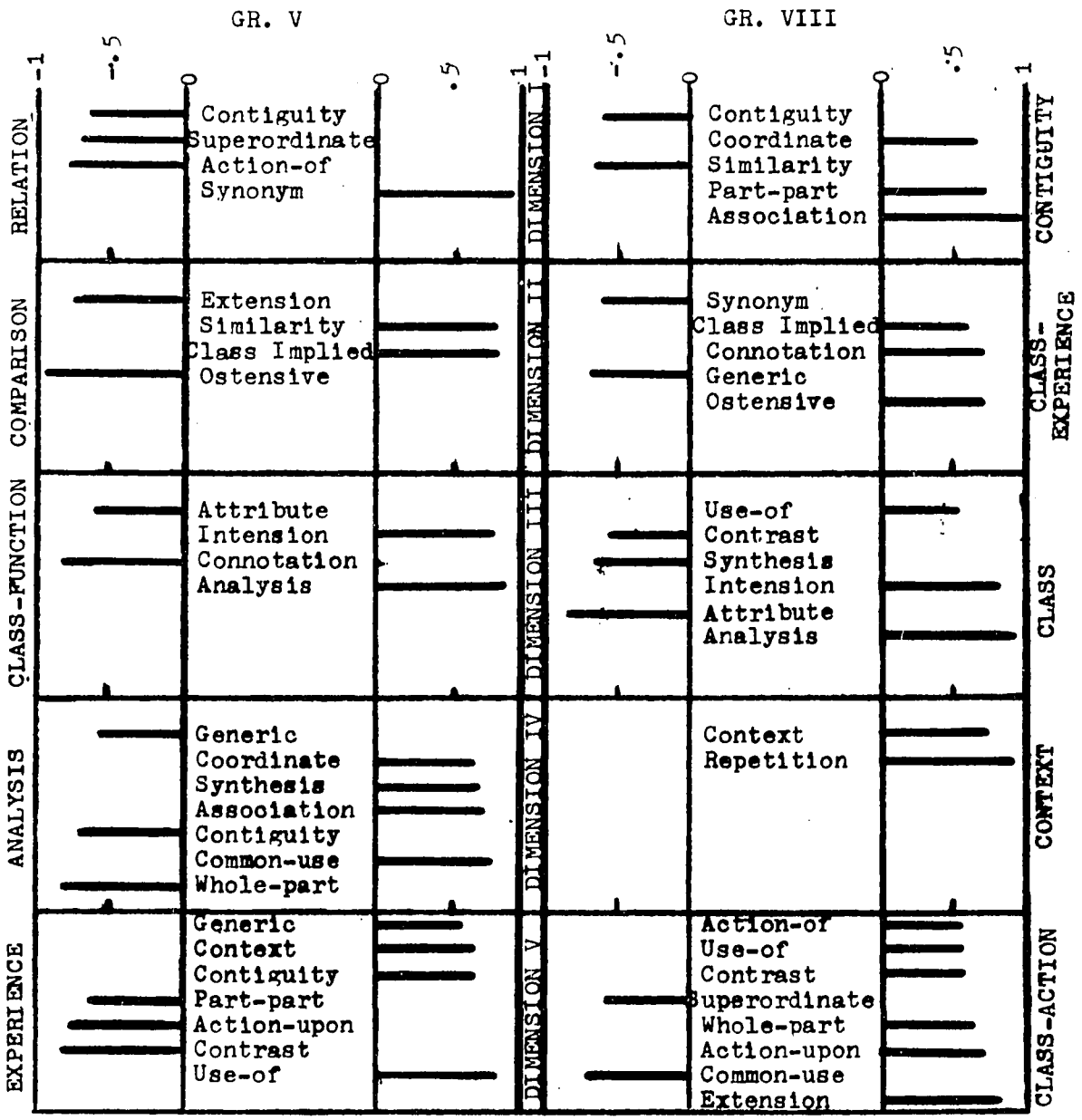


Fig. 17 SEMANTIC FEATURES TEST DIMENSION LOADINGS GR. V - GR. VIII INDIVIDUAL #3

for the older individual suggesting the greater ability of older Ss to set their experiences within a broader class-type organization. The Grade VIII dimension grouped categories which appeared to have a similar psychological nature to a greater extent than did the Grade V dimension.

Dimension III for the Grade VIII individual again appeared to be a psychologically more adequate combination of categories than for the Grade V individual. Both individuals looked at concepts in class terms on this dimension although the Grade VIII dimension was more logical and complete.

Dimension IV differed markedly for the two individuals. The Grade V dimension was broader than the Grade VIII dimension although there was a somewhat inconsistent pattern of categories loading on it. The dimension examined the components of concepts. The Grade VIII dimension examined contextual relations. Although it was a narrow dimension, it illustrated the ability of the older Ss to employ a particular strategy consistently.

Dimension V suggested the importance of experience for both individuals although the Grade VIII individual examined the action and function of concepts, a more mature way of ascribing meaning, as well as attempting to classify these actions. The bipolar nature of dimensions appeared to provide for necessary flexibility in ascribing meaning to words under different contextual conditions.

(b) Idealized Individuals #1 and #3 - Grade V Findings

Table XXVII and Appendix F show loadings on five dimensions for the final configuration of the multidimensional scaling procedure for Idealized Individuals #1 and #3 in Grade V. Table XXVIII presents the Ahmavaara Factor Match between the perceptual spaces.

As with Idealized Individual #3 in both grades these data showed substantial differences in meaning space between individuals in the same grade. The differences, although less gross than those between grades, were of a similar nature. Individual #1 was found to possess a qualitatively superior semantic space employing more general dimensions.

Considering the configuration of variables on dimensions, these dimensions of meaning space have been identified as in Table XXIX.

TABLE XXIX

DIMENSION DESIGNATION
FOR THE MULTIDIMENSIONAL SCALING PROCEDURE ON
THE SEMANTIC FEATURES TEST GRADE V, INDIVIDUALS #1 & #3

Dimension Number	GRADE V Individual #1	Individual #3
1	Contiguity II	Relation
2	Similarity	Comparison
3	Class-Action II	Class-Function
4	Association I	Association
5	Experience I	Contiguity

TABLE XXVII

MULTIDIMENSIONAL SCALING - DIMENSION LOADINGS ON FINAL CONFIGURATION[a]
FOR INDIVIDUALS #1 & #3 GRADE V
ON THE SEMANTIC FEATURES TEST

VARIABLES	DIMENSION LOADINGS[b]									
	DIMENSION I		II		III		IV		V	
	INDIVIDUAL 1	3	1	3	1	3	1	3	1	3
Synonym		.926	-.904				-.661			
Similarity				.801			-.828			
Superordinate		-.688			.501		.558			
Coordinate						-.654	-.574	.652		
Attribute									-.802	-.810
Contrast		-.781			-.862					-.777
Action-of	.894							-.781	.793	
Action-upon							.690			-.715
Whole-part			.624				.688	.774	-.671	
Part-part									.696	.851
Common-use			.591					-.711		.696
Use-of								.707		
Repetition	-.819	-.623			-.751					
Contiguity						-.873				
Association	-.786		.759			.878			-.674	
Connotation							.867	.699		
Analysis									.847	
Synthesis				-.727						.684
Extension	-.826									
Context				-.955	.612					
Ostensive								-.538		.542
Generic	.671									
Class Implied			.774	.820			-.621			
Intension					.904	.745				

[a]Stress - Individual 1 = 0.181, Individual 3 = 0.180; Iterations #1 = 22, #3 = 22
[b]Loadings on dimensions for both individuals shown for ease of comparison
Only highest or equivalent loadings on dimensions are shown

TABLE XXVIII

AHMAVAARA FACTOR MATCH
GRADE V INDIVIDUALS #1 & #3
COMPARISON MATRIX L
FOR THE SEMANTIC FEATURES TEST

	1	2	3	4	5
1.	0.7690	-0.1935	0.2735	0.0305	-0.5437
2	0.1654	0.6539	-0.0735	-0.4381	-0.5897
3.	0.1543	-0.4600	0.8420	-0.1867	0.1438
4.	0.0969	-0.1925	-0.1842	0.8651	-0.4131
5.	-0.0587	-0.7672	0.1972	-0.3471	0.4985

Discussion

Dimension I. Data from the Ahmavaara Factor Match indicated substantial variation between individuals. This dimension is illustrated in Figure 18. For Individual #1 the Contiguity II dimension placed emphasis upon the relationship between concepts including the action performed upon them. One pole of the dimension emphasized the action associated with the concept along with its generic membership. Categories showing high loadings on this pole of the dimension were: action-upon (+), e.g., play - piano, and generic (+), e.g., apple - fruit. The other pole appeared to index the relationships existing between concepts with loadings on contiguity (-), e.g., pebble - found lying on the beach, context (-), e.g., finally - at last he finally went, and connotation (-), e.g., love - good. Dimension I for Individual #1 showed the importance of identifying relationships between concepts to establish meaning.

Dimensions for Individual #3 were discussed in a previous section thus only a summary of their composition will be used in the present comparison. For Individual #3 Dimension I, Relation, placed emphasis upon the relationships existing between symbol and significate (e.g., superordinate) and the label (synonym) commonly applied to the concept. The difference between individuals lay mainly in the role played by the context or the interaction of concepts (contiguity) for Individual #1 as compared

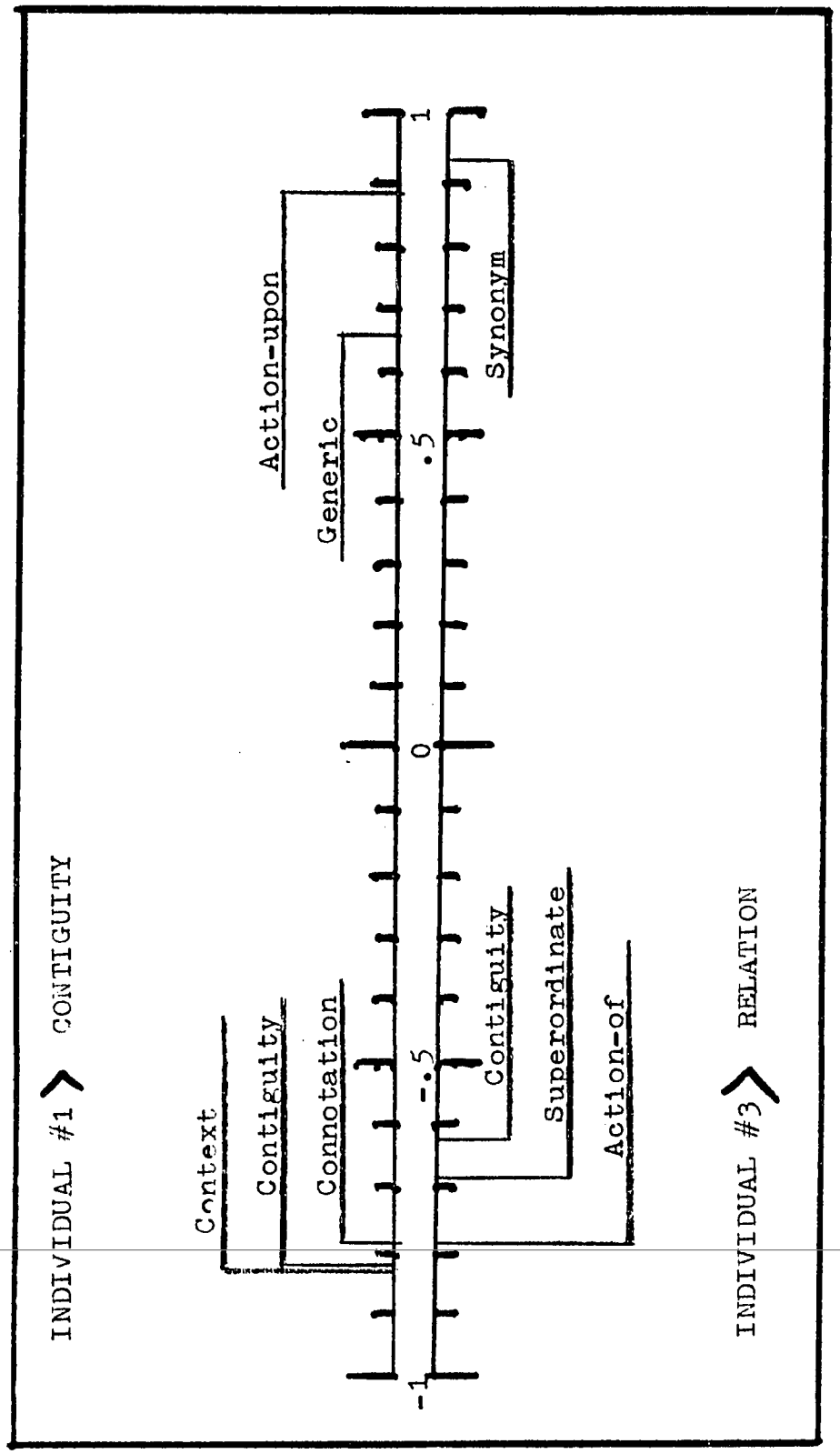


Fig. 18 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION I - GRADE V
INDIVIDUAL #1 - INDIVIDUAL #3

with #3. This individual should be capable of developing richer associations and meaning for words than Individual #3.

Dimension II. The second dimension showed the second lowest degree of congruence on the Ahmavaara Match. This dimension is illustrated in Figure 19. For Individual #1 the Similarity dimension appeared to identify an attempt at a class-type of meaning strategy. The categories loading on this dimension suggested the organization of concepts into patterns of greater inclusiveness. Loading on the one pole, synonym (-), e.g., whole - complete, indicated the identification of the concept. Categories loading on the other pole, part-part (+), e.g., arm - head, repetition (+), e.g., brighten - brighten the color, connotation (+), e.g., unequal - bad, and class implied (+), e.g., elastic - like rubber, suggested the placing of elements of the concept within a somewhat broader framework as well as being concerned for the emotive element of meaning. The dimension, therefore, attempted to identify the similarities between concepts.

Dimension II for Individual #3, Comparison, appeared to define a highly personalized approach to meaning. The categories loading on this dimension suggested a degree of familiarity with the concept or a knowledge of similar concepts. The major difference between individuals on this dimension was in the appeal of #3 to concepts known, for purposes of comparison, while

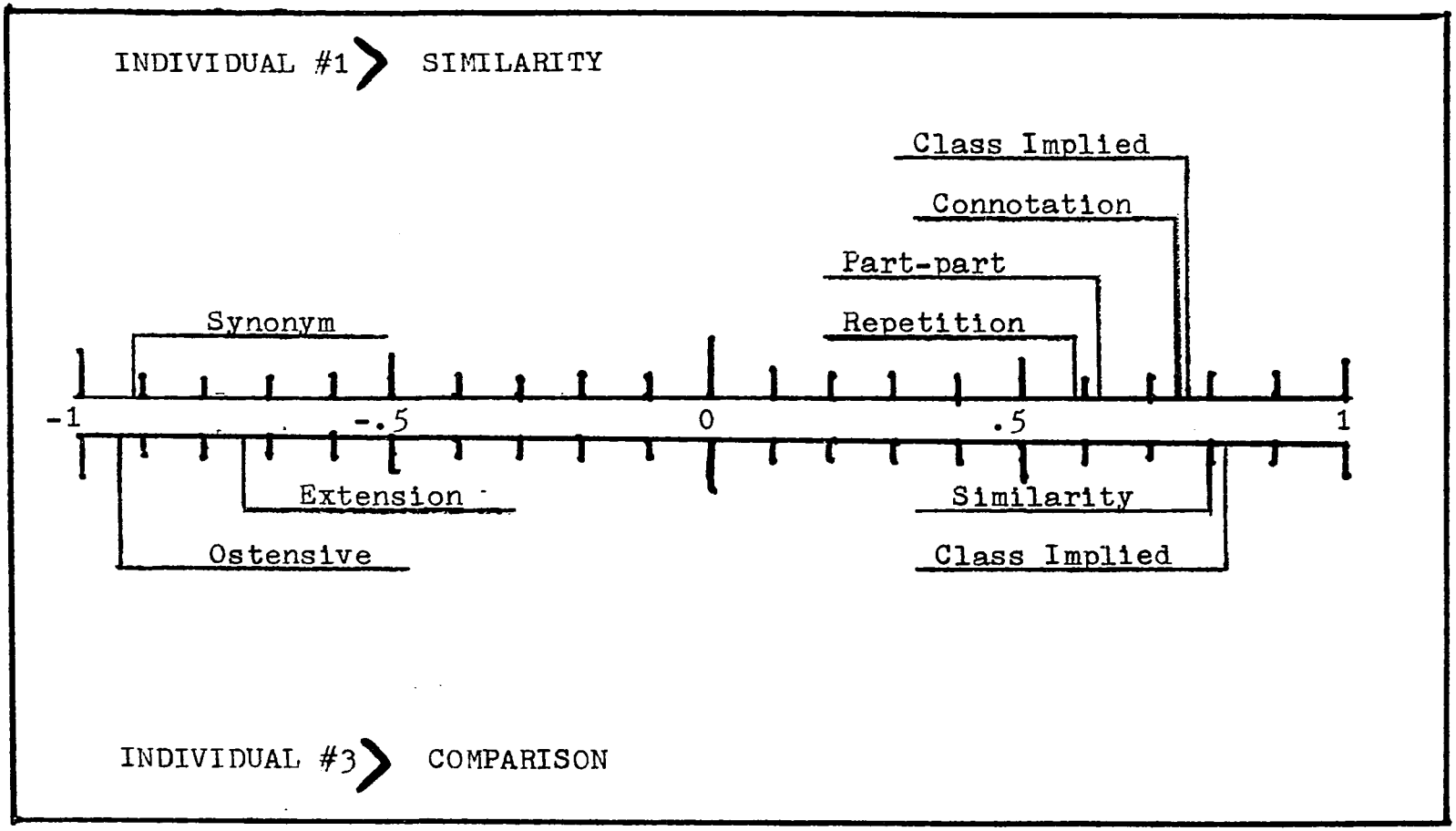


Fig. 19 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION II - GRADE V
INDIVIDUAL #1 - INDIVIDUAL #3

#1 sought to classify similar elements within concepts to identify them. Also, #1 appealed to connotation to develop meaning thus giving it greater breadth. Individual #1, therefore appeared to possess a more productive dimension in that an attempt was made to provide for inclusiveness of concepts within larger categories or classes.

Dimension III. The Ahmavaara Factor Match showed considerable congruence between individuals on this dimension. This dimension is illustrated in Figure 20. Class-Action II for Individual #1 defined one variety of class-type of definitions. Loadings on the one pole, action-of (-), e.g., fire - burn, and association (-), e.g., bright - light, illustrated an action component of meaning. Categories loading on the other pole, coordinate (+), e.g., newspaper - magazine, ostensive (+), e.g., perform - when you do something, and intension (+), e.g., beaver - small furred animal, identified a class orientation to concepts.

Class-Function, for Individual #3, was also a class-type of dimension. The dimension also examined certain characteristics of a concept largely based on the individual's experience with it along with the function of concepts. This dimension differed between individuals largely in the respect that #1 had an action component while #3 had a function component. Also #3 had a high-loading connotation category in his dimension suggesting

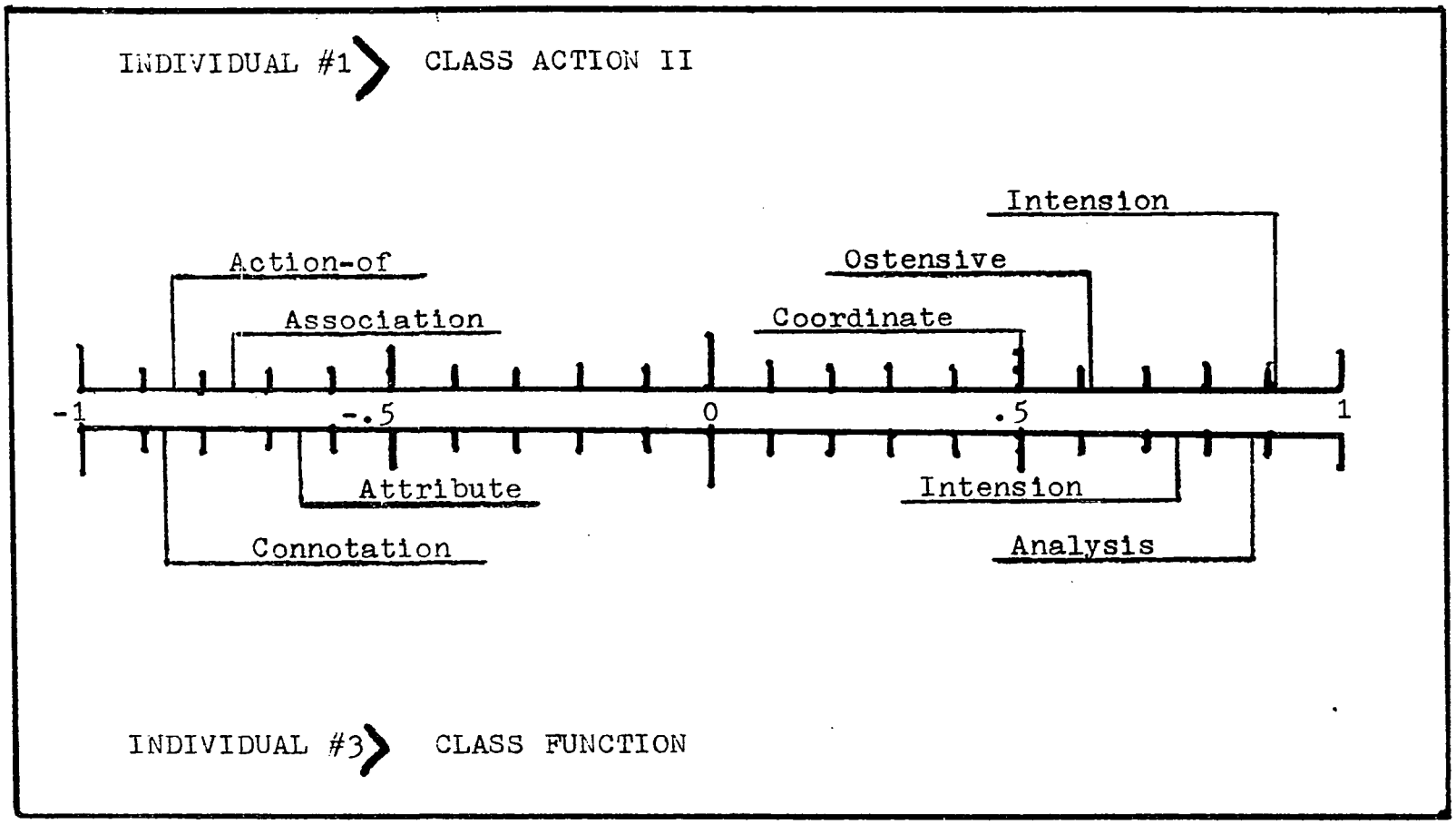


Fig. 20 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION III - GRADE V
INDIVIDUAL #1 - INDIVIDUAL #3

a more personalized interpretation of meaning. Both versions of dimension III were adequate, merely taking somewhat different perspectives upon meaning. Individual #1 with higher loadings on the two most significant categories, intension and action-of, may have the more powerful dimension of the two.

Dimension IV. The Ahmavaara Test showed substantial correlation between individuals on this dimension. This dimension is illustrated graphically in Figure 21. For Individual #1 Association I was a broad dimension with high loadings on many categories. This dimension appeared to be examining the relations between attributes and functions of concepts. The one pole showed loadings on: similarity (-), e.g., great - excellent, superordinate (-), e.g., crowd - man, and attribute (-), e.g., cracker - crisp. This suggested the individual's examination of relations within and between concepts. The second pole loaded on: coordinate (+), e.g., scarf - mittens, part-part (+), e.g., foot - knee, common-use (+), e.g., pupil - scribbler, and synthesis (+), e.g., airline - it has passenger planes. These categories indicated an examination of the ways that concepts may be associated with each other as in the "equal" (coordinate) and the "use" (common-use) categories.

Dimension IV for Individual #3 Association exhibited an approach to meaning through the analysis of the concept in terms of its relations to other concepts.

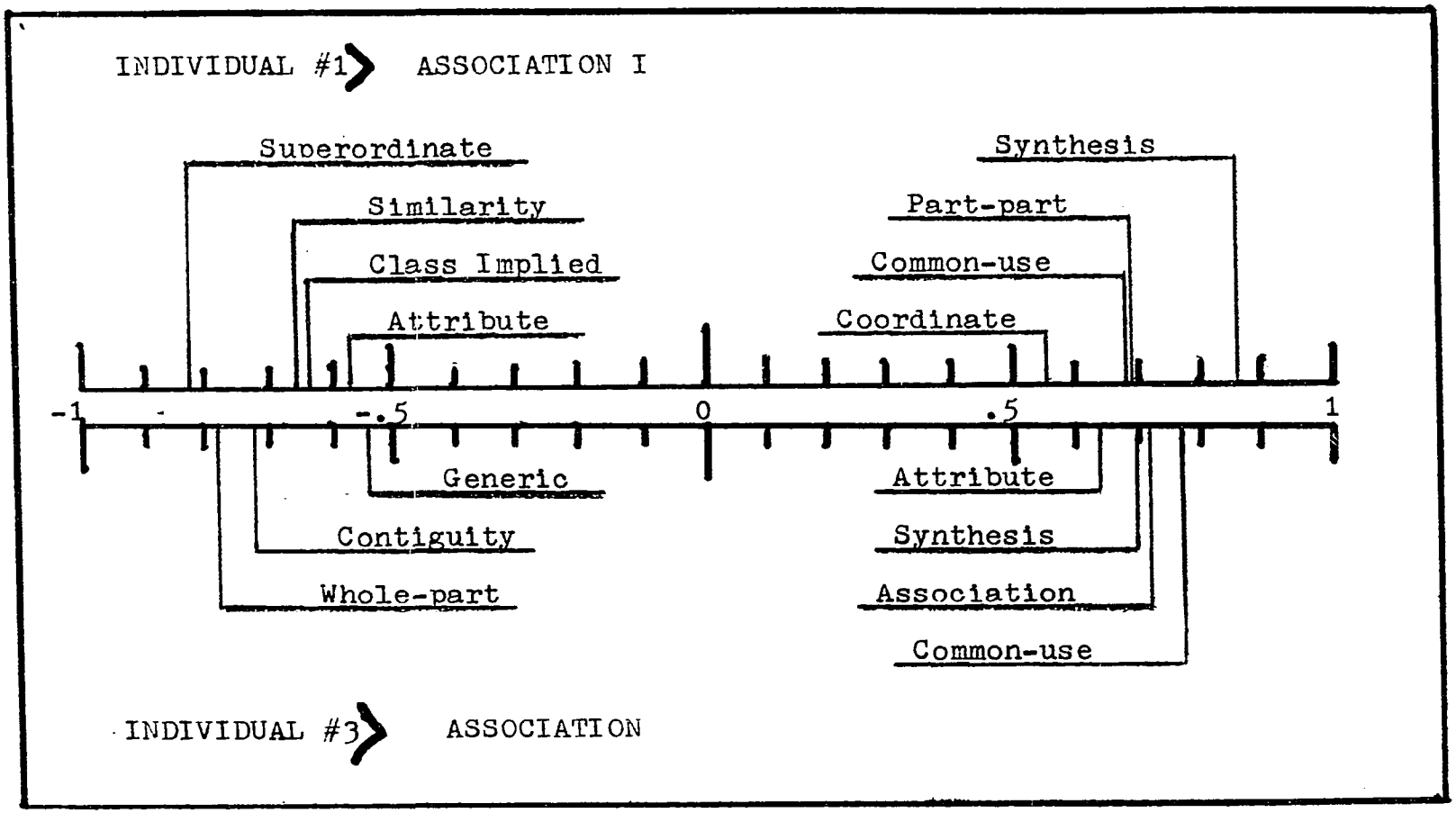


Fig. 21 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION IV - GRADE V
INDIVIDUAL #1 - INDIVIDUAL #3

This dimension was quite similar for the two individuals in that both attempted to identify the relations of the characteristics of concepts. Dimension IV for Individual #1, however, appeared to be somewhat more effective in that it contained a greater number of categories identifying relationships. Also, the loadings were higher on some categories for #1 on this dimension.

Dimension V. The Ahmavaara Test indicated the greatest divergence on this dimension for Individuals #1 and #3. This dimension is illustrated in Figure 22. For Individual #1 Experience I defined a dimension showing the child's dependence upon experience with the characteristics and functions of concepts. The one pole examined the function of concepts through its loadings on contrast (-), e.g., old - young (the function of oppositeness), common-use (-), e.g., carpenter - nail, and analysis (-), e.g., mention - talk to others about something. The other pole showed loadings on categories which consider the individual's familiarity with the concept in terms of other concepts to which it is related. These were: whole-part (+), e.g., tree - branch, use-of (+), e.g., multiplication - for use in arithmetic, and extension (+), e.g., motor - gas and oil.

For Individual #3 Contiguity defined a dimension showing the child's dependence upon knowledge of interaction among concepts. It examined both the individual's experience with the functional relations between concepts

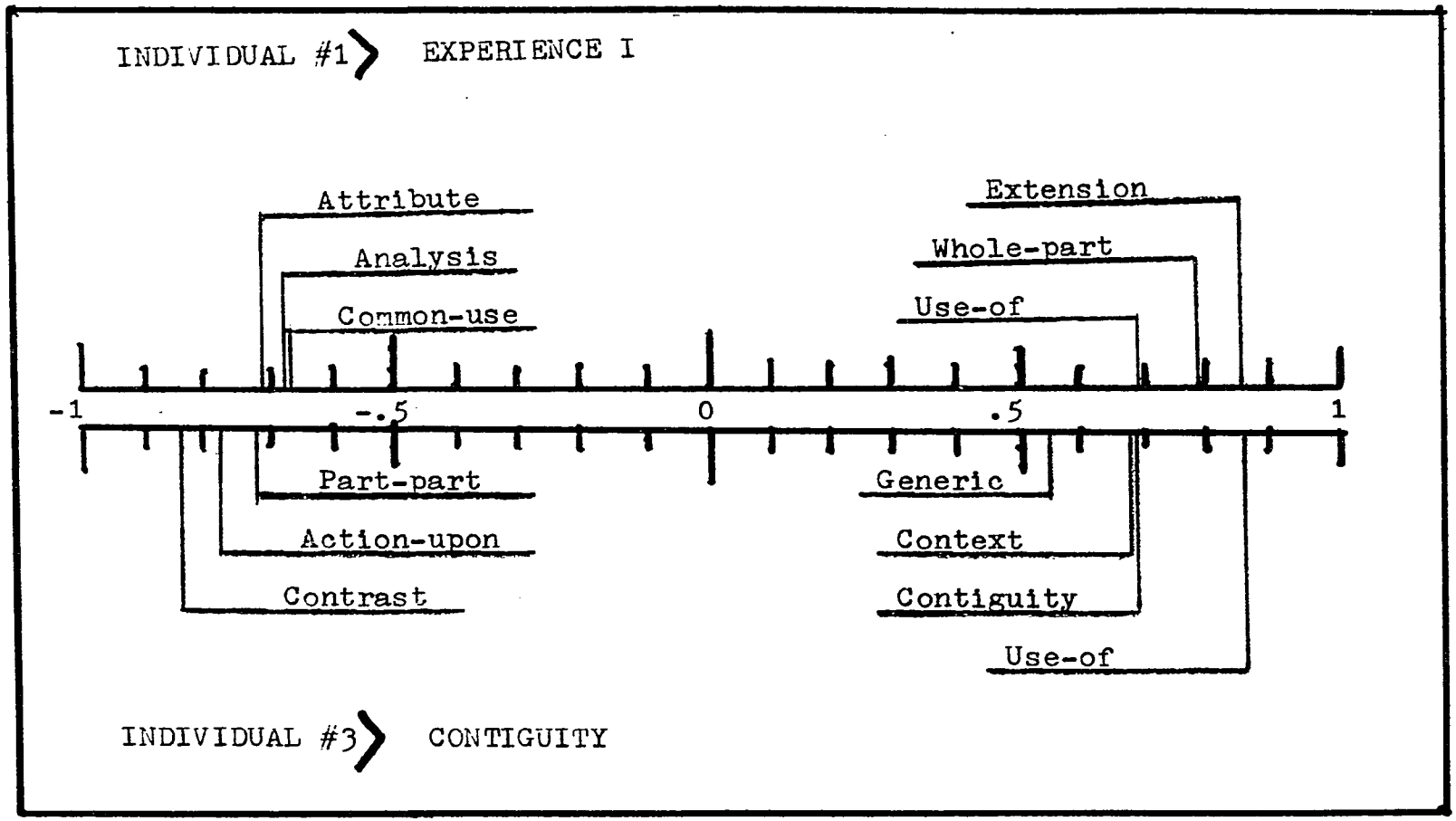


Fig. 22 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION V - GRADE V
INDIVIDUAL #1 - INDIVIDUAL #3

and the interactions or contiguous relations between concepts. This dimension differs between individuals in that #1 looked to personal experience with the concept while #3 sought out relationships among concepts. Dimension V for Individual #3, therefore, appeared to be more adequate in that it had more general applicability since it didn't depend upon personal experience as much as for Individual #1.

Summary

Considering the total configuration of dimensions for the two individuals it appeared that Individual #1 possessed greater semantic competence in that his strategies of signification in all but one of the dimensions were broader and more general than those of Individual #3 (Fig. 23). Dimension I should permit him to develop richer associations between words and significates, Dimension II would provide for the inclusion of concepts within larger categories, Dimension III would enable this individual to classify concepts and consider their active role more adequately while Dimension IV would give him somewhat greater breadth in relating characteristics of concepts. Only on Dimension V did Individual #1 appear to be less competent than #3. Here #1 appealed to personal experience more than #3. But considering the nature of his other dimensions this may be necessary to provide for a deeper, more personalized

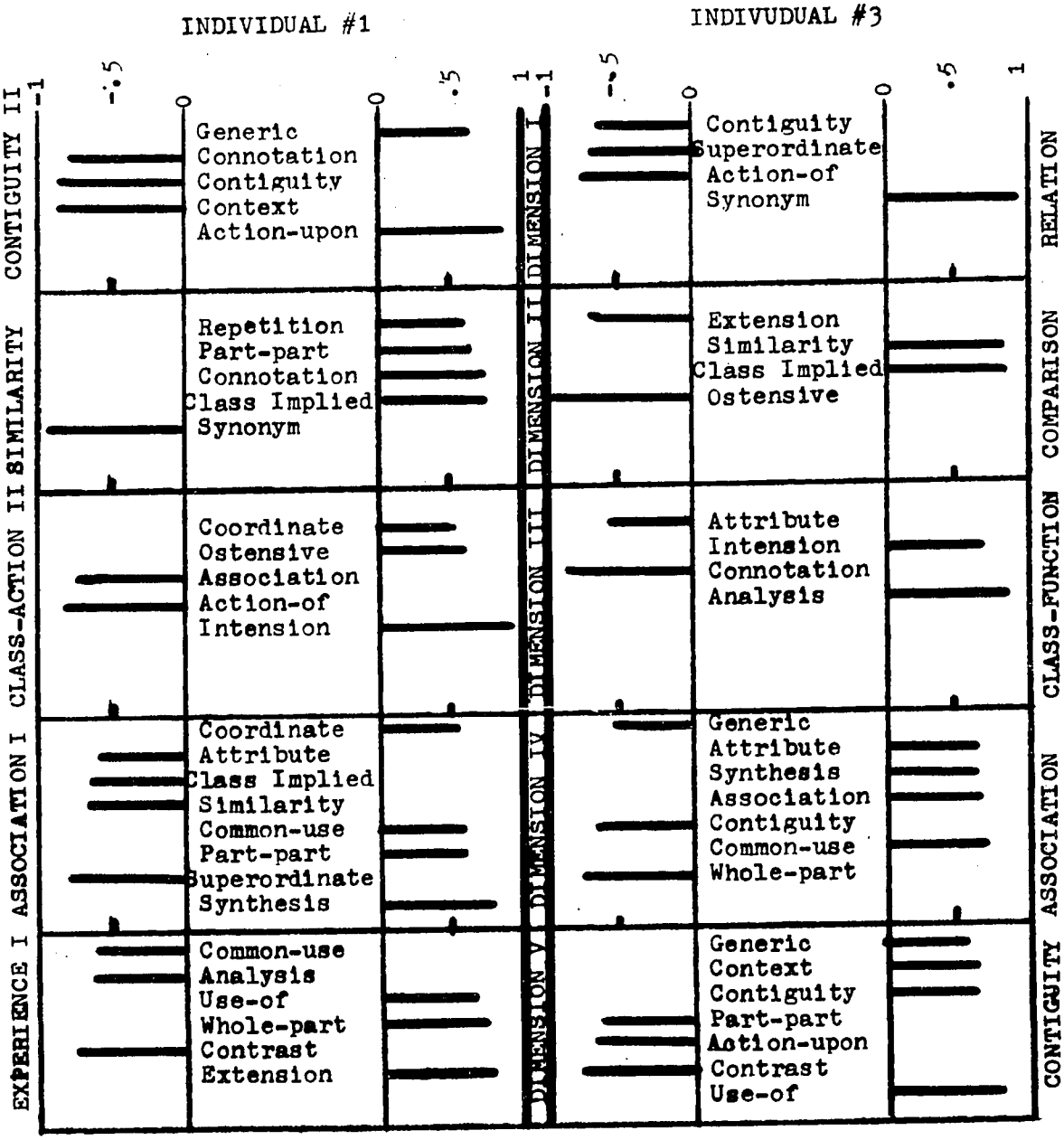


Fig. 23 SEMANTIC FEATURES TEST DIMENSION LOADINGS INDIVIDUALS #1 - #3
GRADE V

meaning for concepts he had already identified.

(c) Idealized Individuals #1 and #3 - Grade VIII Findings

Table XXX and Appendix F present loadings on five dimensions for the final configuration of the multidimensional scaling procedure for Idealized Individuals #1 and #3 in Grade VIII. Table XXXI shows the Ahmavaara Factor Match between the perceptual spaces. The dimensions are identified in Table XXXII.

Differences were found to exist between meaning spaces for the two individuals with Individual #1 possessing a somewhat more efficient strategy of signification than did Individual #3. His meaning space appeared to consist of more dimensions which ascribe meaning to words by identifying their class membership. This suggested a reduction in cognitive effort.

TABLE XXXII

DIMENSIONS DESIGNATION
FOR THE MULTIDIMENSIONAL SCALING PROCEDURE ON
THE SEMANTIC FEATURES TEST GRADE VIII, INDIVIDUALS #1 & #3

Dimension Number	GRADE VIII Individual #1	Individual #3
1	Class-Action I	Contiguity
2	Class Implied	Class-Experience
3	Experience	Class
4	Class-Relation	Context
5	Contiguity	Class-Action

TABLE XXX

MULTIDIMENSIONAL SCALING - DIMENSION LOADINGS ON FINAL CONFIGURATION[a]
FOR INDIVIDUALS #1 & #3 GRADE VIII
ON THE SEMANTIC FEATURES TEST

VARIABLES	DIMENSION LOADINGS[b]									
	DIMENSION I		II		III		IV		V	
	INDIVIDUAL 1	3	1	3	1	3	1	3	1	3
Synonym			-.767	-.650						
Similarity	-.610	-.701					-.659			
Superordinate							-.735			-.623
Coordinate		.677					.762			
Attribute					-.722	-.884				
Contrast						-.598			-.834	.564
Action-of	-.832									.549
Action-upon	.655									.723
Whole-part	668		.648							
Part-part		.705	-.802							
Common-use							.540		-.566	-.754
Use-of					.773	.516				.551
Repetition			-.768					.914		
Contiguity		-.671							-.691	
Association	.843	.970								
Connotation			.708	.728	-.738					
Analysis					.756	.927				
Synthesis						-.636	.864			
Extension									.993	.823
Context			.786					.823		
Ostensive				.774	-.824					
Generic	.659			-.774			-.688			
Class Implied			.704	.685						
Intension	-.772					.841				

[a]Stress - Individual 1 = 0.177, Individual 3 = 0.179; Iterations - #1 = 17, #3 = 16
[b]Loadings on dimensions for both individuals shown for ease of comparison
Only highest or equivalent loadings on dimensions are shown

TABLE XXXI

AHMAVAARA FACTOR MATCH
GRADE VIII INDIVIDUALS #1 & #3
COMPARISON MATRIX L
FOR THE SEMANTIC FEATURES TEST

	1	2	3	4	5
1.	0.9231	-0.1136	-0.0572	0.3312	-0.1482
2.	0.1156	0.4860	-0.3446	0.7947	0.0141
3.	0.0423	-0.3570	0.8970	0.2350	-0.1044
4.	0.0271	0.4743	-0.2284	0.6894	0.4968
5.	0.3210	-0.0030	0.0386	-0.3117	0.8935

Discussion

Dimension I. Data from the Ahmavaara Factor Match indicated substantial congruence between Individuals #1 and #3 on this dimension. This dimension is illustrated in Figure 24. For Individual #1 the Class-Action dimension identified the class membership of concepts along with the action associated with them. One pole of the dimension emphasized one aspect of class membership and action with loadings on similarity (-), e.g., gradually - at once, action-of (-), e.g., baby-sitter - watch, and intension (-), e.g., canal - man-made river. The other pole identified another aspect of class membership and action. High loadings occurred on: action-upon (+), e.g., paint - picture, whole-part (+), e.g., house - window, association (+), e.g., pleasant - happy, and generic (+), e.g., cinnamon - flavoring.

As for the Grade V individuals, #3 has been discussed in detail elsewhere thus only a summary of the dimension is given. Dimension I for Individual #3, Contiguity emphasized relationships between concepts and experience with the referent. The categories loading on this dimension appeared to define the individual's attempt to analyze the components of the concept as well as to associate the concept with something known. The difference between individuals was seen in the more complex and adequate dimension for Individual #1 as compared with #3. This dimension, one of many possible class-type

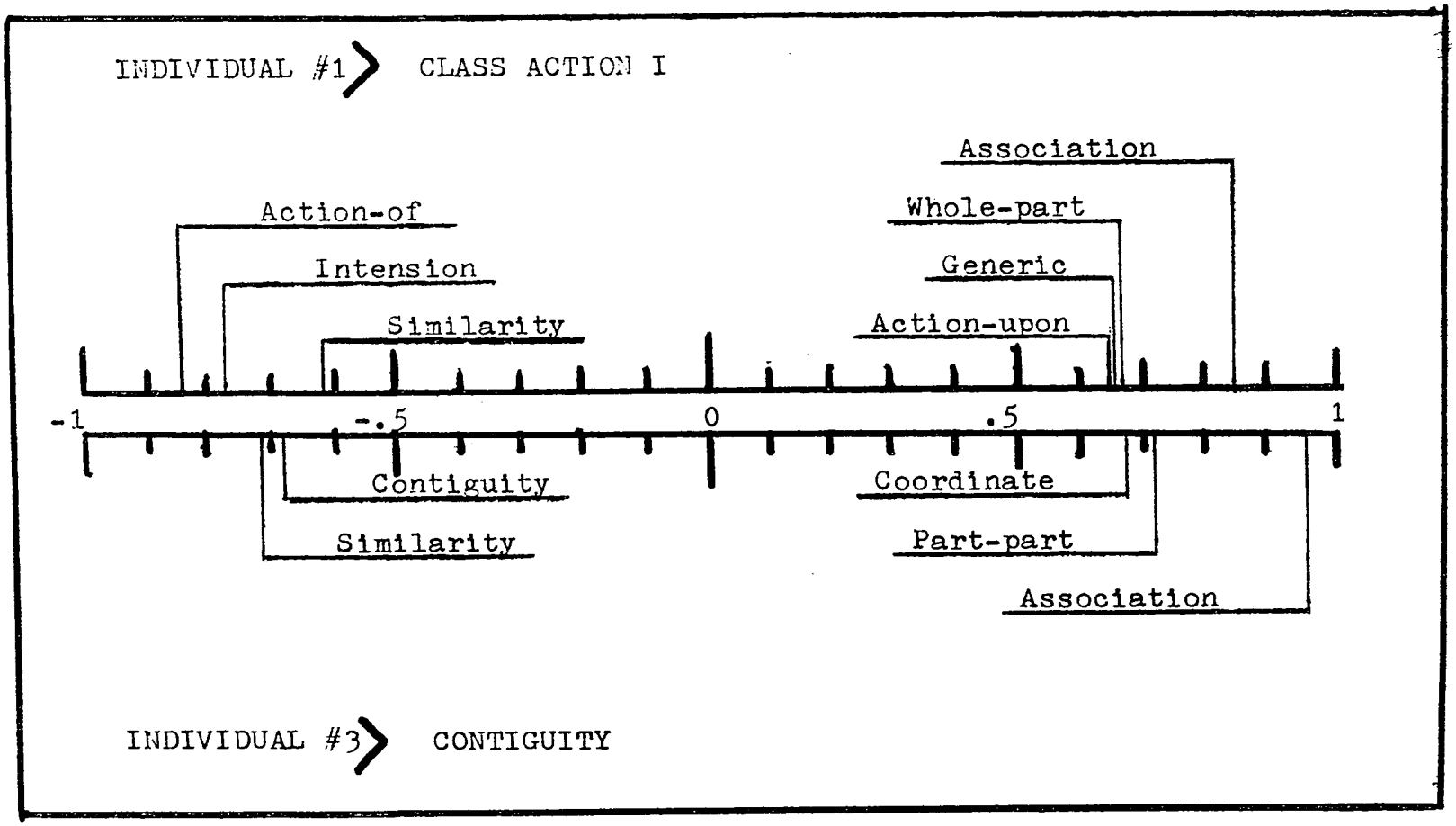


Fig. 24 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION I- GRADE VIII
INDIVIDUAL #1 - INDIVIDUAL #3

dimensions provided a more economical and powerful strategy of signification. It appeared to permit the identification of a concept through its class membership and function rather than merely one's experience with it.

Dimension II. The second dimension showed the lowest congruence on the Ahmavaara Match. This dimension is illustrated in Figure 25. For Individual #1 the Class-Implied dimension appeared to identify another clas-type dimension. The one pole loaded on synonym (-), e.g., surely - definitely, part-part (-), e.g., headlight - brake, and repetition (-), e.g., arrange - arrange all the pieces. These categories identified the relationship of concepts (as in synonym). The other pole showed loadings on whole-part (+), e.g., playful - good, context (+), e.g., generally - generally it is so, and class implied (+), e.g., silvery - like silver. The emphasis in these categories was upon the relation of a concept to categories of greater inclusiveness (as in whole-part and class implied).

Dimension II for Individual #3, Class Experience, was a well developed component of meaning space for this individual. This dimension consisted of a class membership orientation to meaning, as exemplified by the generic category, along with an examination of experiences associated with the concept. The major difference between individuals was in the greater logical consistency and breadth of Dimension II for Individual #1. Both

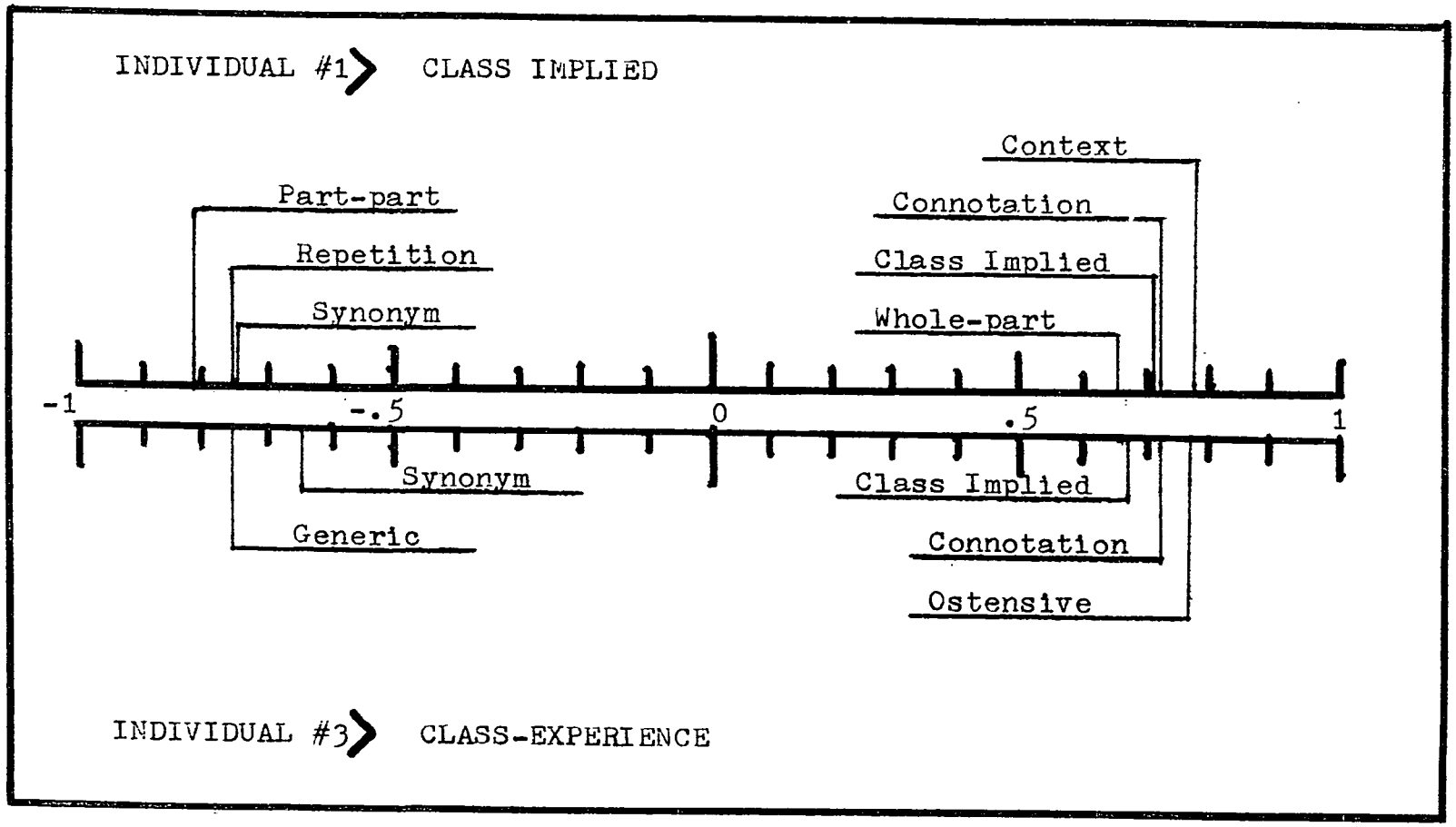


Fig. 25 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION II - GRADE VIII
INDIVIDUAL #1 - INDIVIDUAL #3

individuals used a class membership approach to meaning. However #1 included such necessary components as the context, whole-part, and part-part categories thus making this dimension more powerful.

Dimension III. The Ahmavaara Factor Match showed a substantial congruence between individuals on this dimension. This dimension is illustrated in Figure 26. Experience for Individual #1 identified a dimension concerned with examining meaning through the experiences associated with concepts. Loadings on the one pole, attribute (-), e.g., mystery - strange, connotation (-), e.g., unafraid - good, and ostensive (-), e.g., completely - you finish your work, defined an approach to meaning emphasizing the quality of experience. This included personal reaction (ostensive and connotation categories) and experience with characterisitcs of concepts (attribute). Categories loading on the other pole, use-of (+), e.g., eyeglass - for helping to see better, and analysis (+), e.g., outstanding - important work, identified an examination of the function of concepts as revealed through experience. This combination of categories suggested a class grouping on the basis of experience.

Dimension III for Individual #3, Class, was a powerful class-type dimension. This dimension consisted of an attribute view of meaning balanced by class and class-related components. This dimension differed between individuals in that #3 employed a more economical and

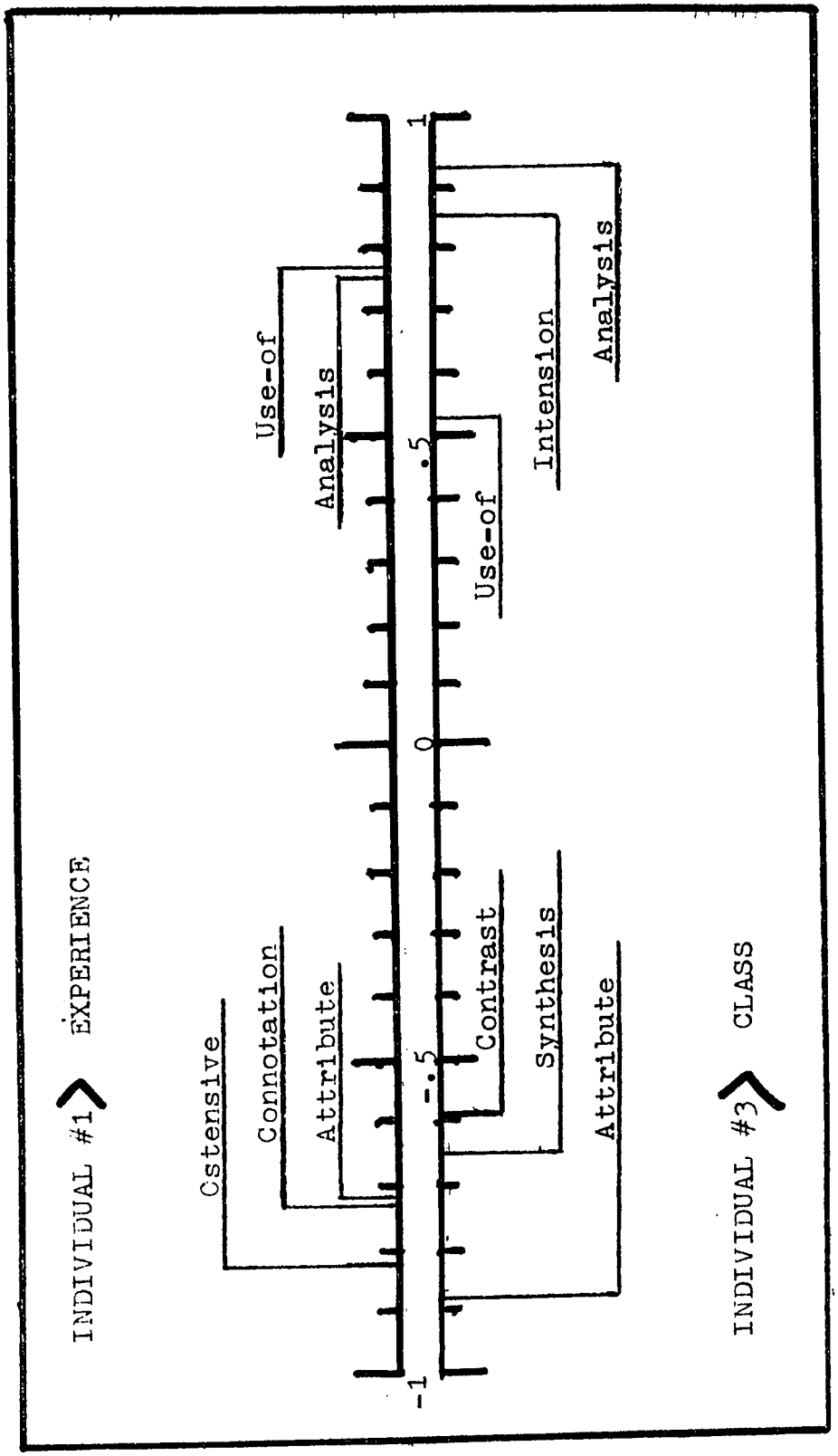


Fig. 26 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION III - GRADE VIII
INDIVIDUAL #1 - INDIVIDUAL #3

productive class-membership dimension to identify concepts. Individual #1, on the other hand, used this dimension to identify meanings through his experiences. However, the categories in this dimension have a logical consistency suggesting classification. Individual #3, therefore, should be more capable of understanding new concepts and using known concepts broadly.

Dimension IV. The Ahmavaara Test revealed considerable divergence on this dimension. This dimension is illustrated in Figure 27. For Individual #1 Class-Relation was a broad dimension having high loadings on many categories. This dimension emphasized the kinds of relations existing between concepts. The one pole showed the relation of concepts to others in patterns of greater inclusiveness. High loadings occurred on: similarity (-), e.g., bold - very brave, superordinate (-), e.g., footwear - slipper, and generic (-), e.g., apple - fruit. These categories identify class relations. The other pole loaded on: coordinate (+), e.g., breakfast - supper, common-use (+), e.g., waiter - menu, and synthesis (+), e.g., shampoo - it has suds. These categories show some of the possible relations between concepts.

Dimension IV for Individual #3, Context, was very narrow having substantial loadings on only one pole. This dimension appeared to examine contextual relations between concepts. The dimension differed between individuals to the extent that #1 used a class-type of

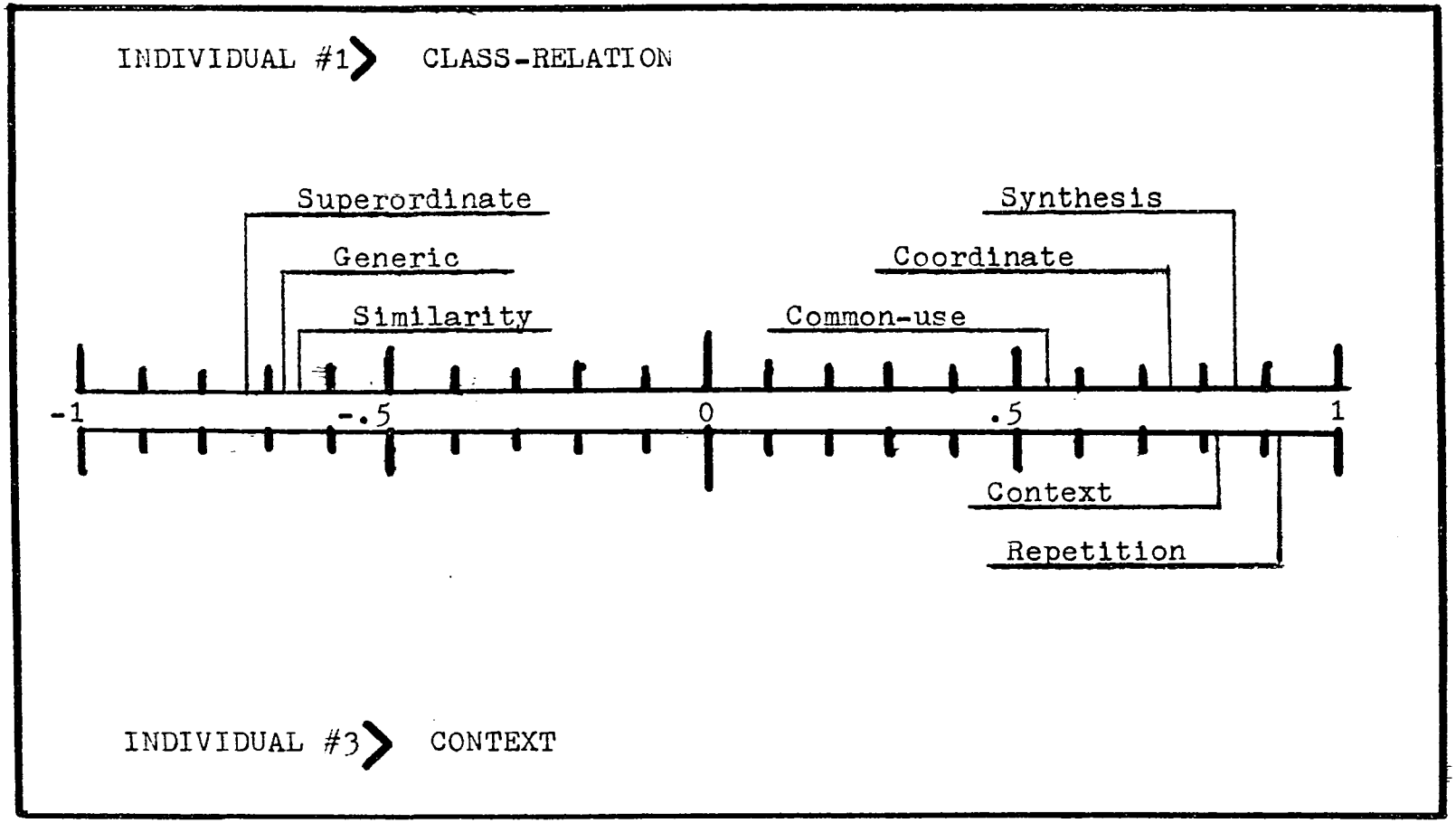


Fig. 27 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING
DIMENSION LOADINGS - DIMENSION IV - GRADE VIII
INDIVIDUAL #1 - INDIVIDUAL #3

organization of meaning while #3 depended upon context to help him identify the concept. Dimension IV for Individual #1 should, therefore, enable him to identify concepts more readily and completely through their membership in a broader category as well as their relations to each other. Individual #3, on the other hand, must depend upon the immediate context for meaning.

Dimension V. The Ahmavaara Test showed considerable congruence for Individuals #1 and #3 on this dimension. Figure 28 illustrates Dimension V. For Individual #1 Contiguity I identified a dimension concerned with ascribing meaning on the basis of experience or direct interaction (contiguity) of concepts. The one pole, having a single though very high loading category, looked for examples of the concept which suggested the need for experience with the referent. The high loading occurred on extension (+), e.g., jewel - diamond or ruby. The other pole loaded on: contrast (-), e.g., later - earlier, contiguity (-), e.g., electricity - carried by wires, and common-use (-), e.g., doctor - drug. These categories show the importance of concepts related by direct interaction of contrast, place and time, or activity with the referent.

Dimension V for Individual #3, Class-Action, identified an attempt by this individual to classify concepts according to their function and action. This dimension attempted to categorize concepts on the basis

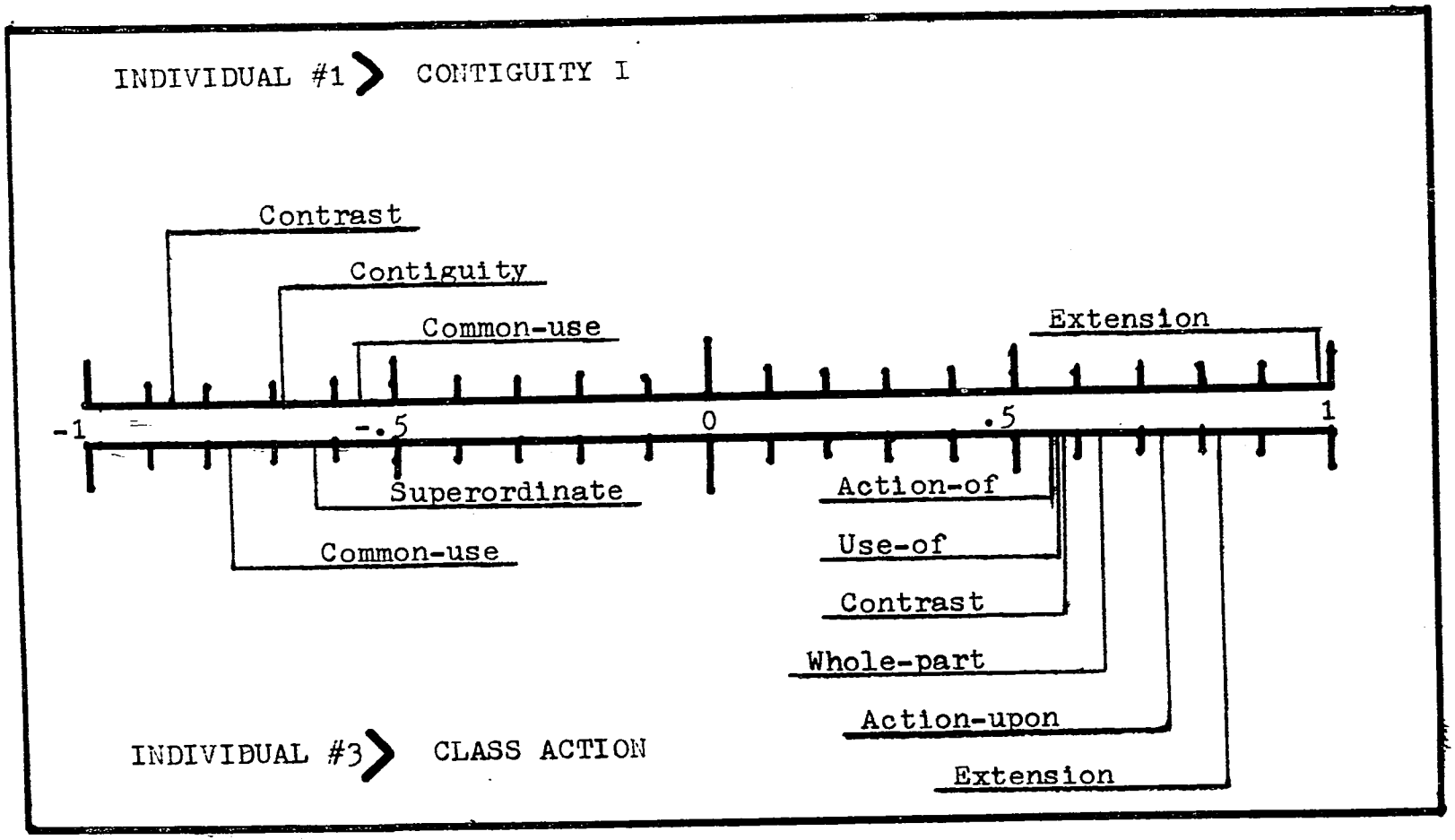


Fig. 28 SEMANTIC FEATURES TEST MULTIDIMENSIONAL SCALING DIMENSION LOADINGS - DIMENSION V - GRADE VIII INDIVIDUAL #1 - INDIVIDUAL #3

of their use and purpose as well as the action performed upon and by them. The dimension differed between individuals in that #3 used the more economical strategy of determining class membership in processing verbal data. The basis of classification appeared to be function and action rather than the more logical and mature one of attribute. Nevertheless, this dimension was likely to be more productive for Individual #3 than #1 who depended upon personal experience and familiarity with the concept or upon the direct interaction of concepts.

Summary

Considering the total configuration of dimensions for Individuals #1 and #3 in Grade VIII it appeared that Individual #1 possessed a somewhat more efficient strategy for processing linguistic data to arrive at the meanings of words (Fig. 29). His meaning space was comprised of dimensions which, in three out of the five cases, were more economical of cognitive effort in ascribing meaning to words by identifying their class membership and more powerful in the processing of verbal stimuli by placing these words within patterns of greater inclusiveness. Dimension I should permit this individual to identify a concept through class membership and function. Dimension II for Individual #1 appeared more potent than the same dimension for #3 in that it considered more information in attempting to classify concepts (e.g. context and part-part).

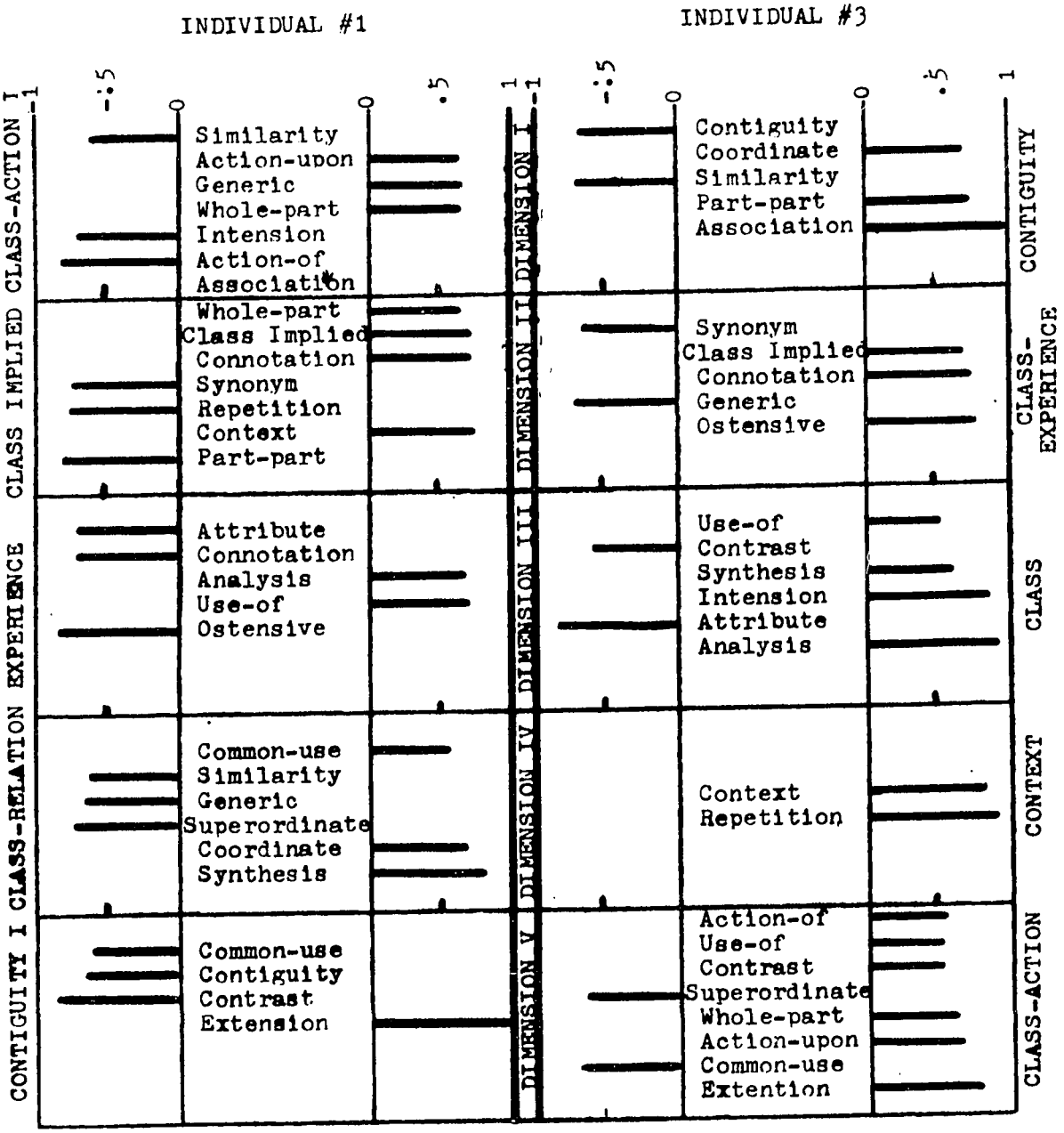


Fig. 29 SEMANTIC FEATURES TEST DIMENSION LOADINGS INDIVIDUALS #1 - #3
GRADE VIII

Dimension IV should enable #1 to classify concepts and therefore ascribe meaning to them on the basis of relations among them. Individual #3, on the other hand, possessed a more effective strategy in his Dimension III (Class) than the corresponding dimension for #1. Also his Dimension V, another Class-type dimension appeared more efficient than the corresponding dimension for #1. Taken all together, therefore, Individual #1 would appear to be the more competent of the two although the difference is not as marked as for the Ss in Grade V. This may be due to the effect of schooling, i.e., the older Ss have learned how to process words more adequately.

Personal Characteristics of Idealized Individuals

Descriptive data about pupils were collected during the treatment period. These data concerned the following experimental variables considered to have a bearing upon the problem: intelligence, place of residence, socio-economic status, and academic performance. Subsequent to the identification of the "idealized" individuals, data quantifying the above variables were collated. Tables XXXIII and XXXIV summarize and compare this information for the two individuals examined within Grades V and VIII. Table XXV presents a comparison of Individual #3 in Grades V and VIII as discussed in a previous section.

The sex variable was examined in terms of the proportions of males and females within the idealized

individual. The significance of differences between proportions for each individual was calculated to determine the nature, in terms of sex, of this individual.

Age was calculated in terms of years and the significance of differences between individuals was examined.

The proportions of Ss falling within the three population strata, urban, small town, and rural, for each idealized individual were computed. The significance of differences between these proportions was calculated to identify the relationship of place of residence to semantic competence.

Socio-economic status of constituent members of each idealized individual was obtained through the Blishen scale (Blishen et al., 1968). Increasing values on the scale indicate a higher SES. The significance of differences between values of this index for the two individuals was computed to determine the relation between SES and the nature of semantic space.

Data from the California Test of Mental Maturity were compared between individuals through analysis of variance to identify significant differences regarding certain intellectual characteristics.

In general, where more than one characteristic was present within a variable for the individual, e.g., place of residence, differences between these characteristics for that individual were examined. Where the variable consisted of a single characteristic, e.g., CTMM

data, differences between individuals were considered.

(a) Grade V Individuals #1 and #3

Individuals #1 and #3 in Grade V, Table XXXIII, were comparable on the majority of the variables considered to influence semantic competence although Individual #1 had a more efficient semantic space according to the interpretation of the SF test data. The single exception was place of residence. Individual #1 was more likely to reside in an urban or rural setting than was Individual #3. Therefore, it appears that individuals living in either of these locations are more likely to receive experiences leading to the development of a more adequate and mature strategy for processing words. This is contrary to findings of other studies where individuals in rural areas were discovered to be at a disadvantage in intellectual tasks. The cause of the difference in findings may be that the quality of rural life has changed dramatically in recent years. A farmer's socio-economic status is rated within the upper levels (Blishen, 1968, p. 745). Presently, the same amenities are available to farmers as to nonfarm dwellers and central Alberta farms are generally among the most modern and productive in the province. The small towns, on the other hand, may be less capable of providing the richness of experience available in either larger centres or in well established rural areas. Also, many studies include small towns within the "rural" sample, making the

TABLE XXXIII

CERTAIN CHARACTERISTICS OF IDEALIZED INDIVIDUALS
GRADE V

INDIVIDUAL #1	INDIVIDUAL #3
SEX ... Male .47, Female .53	SEX ... Male .48, Female .52
AGE ..... 11.11 years	AGE ..... 11.15 years
PLACE OF RESIDENCE: Urban/Rural> Small Town ***	PLACE OF RESIDENCE: Urban/Small Town/Rural
OCCUPATION OF BREADWINNER: Mean Socio-economic index for occupations[a] 44.01	OCCUPATION OF BREADWINNER: Mean Socio-economic index for occupations 45.96
CTMM DATA:	CTMM DATA:
i. Total IQ 106	i. Total IQ 106
ii. Language IQ 109	ii. Language IQ 107
iii. Non Language IQ . 104	iii. Non Language IQ . 104
iv. Verbal Comprehension 17/25	iv. Verbal Comprehension 17/25
v. Memory 17/25	v. Memory 16/25

*** $p \leq .001$

[a] Blishen et al., 1968

distinction between large urban centres and non-urban centres only. The present study discriminates more finely in terms of place of residence. Finally, the treatment administered to the Ss was unlike that in other studies, making direct comparisons inappropriate.

Individuals #1 and #3 showed no significant sex differentiation. Studies generally produced equivocal results in respect to this factor (Russell, 1954, p. 362). It appeared that both boys and girls develop similar kinds of semantic spaces.

Age did not vary significantly between these individuals. Within the narrow age range of this grade group chronological age did not appear to be associated with the occurrence of a more or less adequate semantic space.

Socio-economic status as measured by the occupation of the breadwinner in the family showed no variation between individuals. Russell (1954, p. 365) has shown that there is a substantial correlation between vocabulary performance and indices of socio-economic status. The present results suggest that SES within the mid range is associated with a variety of semantic competencies. This is understandable since the range of meaning-development experience is extremely broad within this SES level.

The California Test of Mental Maturity showed interesting results for the two individuals. In a previous section it was shown that the CTMM is a measure

of two basically distinct group factors, the verbal-educational and the spatial-mechanical groups. Also it was suggested that the Semantic Features Test is essentially a measure of the individual's verbal-educational ability. The intelligence characteristics of Individuals #1 and #3 did not vary significantly on their CTMM profiles indicating that the CTMM has limited ability to identify the kinds of verbal-educational functioning tapped by the SF Test. Also it appeared that the conventional synonym-type of vocabulary test, which is represented by the Verbal Comprehension subtest of the CTMM, cannot distinguish consistently between the qualitative levels of semantic functioning.

The several characteristics described above cannot be said to be either singly or together instrumental in the formation of an individual's meaning space although they are associated with its development to a greater or lesser degree. Therefore, other factors, as yet not identified specifically, have a degree of influence upon an individual's semantic competence.

(b) Grade VIII Individuals #1 and #3

In Grade VIII, Individuals #1 and #3, Table XXXIV, differed quite markedly on several of the measured characteristics. Sex and age were the only characteristics found not to differ significantly, a result in keeping with the findings in Grade V. Also, as in Grade V, Individual #1 was found to have the more mature and

TABLE XXXIV

CERTAIN CHARACTERISTICS OF IDEALIZED INDIVIDUALS
GRADE VIII

INDIVIDUAL #1	INDIVIDUAL #3
SEX ... Male .43, Female .57	SEX ... Male .58, Female .42
AGE ..... 14.04 years	AGE ..... 13.96 years
PLACE OF RESIDENCE: Urban/Small Town/Rural	PLACE OF RESIDENCE: Small Town>Urban* Small Town>Rural**
OCCUPATION OF BREADWINNER: Mean Socio-economic index for occupations[a] 53.70[b]	OCCUPATION OF BREADWINNER: Mean Socio-economic index for occupations 44.64
CTMM DATA:	CTMM DATA:
i. Total IQ 115**	i. Total IQ 110
ii. Language IQ 115**	ii. Language IQ 111
iii. Non Language IQ . 115**	iii. Non Language IQ ... 108
iv. Verbal Comprehension .... 21/25[b]	iv. Verbal Comprehension 18.7/25
v. Memory 18/25	v. Memory 18.3/25

* $p \leq .05$
** $p \leq .01$

[a] Blishen et al., 1968
[b] $p = .065$ (one tail test)

efficient semantic space.

Place of residence of the child and the occupation of the parent both showed significant differences between individuals. Individual #1 was found to be equally represented in urban, small town, and rural children. The SES statistic indicated that it was the children of higher socio-economic status parents living in these three locations who constituted Idealized Individual #1. At the same time, the children of lower SES parents living significantly more often in small towns than in cities or rural centres were found to constitute Individual #3. These findings provided evidence for the common contention among language arts investigators that semantic competence is correlated with the individual's socio-economic status and the associated factor of place of residence. A level of significance slightly in excess of the more commonly employed $p \leq .05$ was considered to be acceptable in the present circumstances since the investigator sought to identify basic relationships among variables.

The Individuals' intellectual abilities as measured by the CTMM showed significant differences on most pertinent elements of this test all favoring Individual #1. This result was not unexpected in that Individual #1 was identified as having the more efficient semantic space of the two. The result suggested that a higher level of intellectual functioning as identified by a conventional intelligence test was associated with increased semantic

competence. This finding was also considered to provide evidence for the validity of the Semantic Features Test. The SF Test was capable of differentiating between levels of verbal behavior and the levels identified by it could be said to differ upon a known co-variant of semantic behavior, i.e., intellectual ability. Finally, the information provided by the verbal section of the test (Language I.Q., Verbal Comprehension score, Memory score) show the shortcomings of a quantitative type of measure of a cognitive process. The values assigned to the behaviors indexed by the subtests in the verbal section of the CTMM indicate little in the way of what the individual can do or how he does it in the area of interest, semantic behavior.

(c) Individual #3 Grades V and VIII

Individual #3 in Grades V and VIII, Table XXXV, have been compared in respect to their semantic space in a previous section. It was seen that Individual #3 in Grade VIII possessed a more mature and powerful semantic space, capable of more efficiently ascribing meaning to words, than Individual #3 in Grade V. These individuals were highly comparable except for age and place of residence. The Grade VIII individual, who was more likely to be a small town resident, was older than the Grade V individual. Vocabulary studies commonly show an increasing vocabulary competence with age. This result was also noted in the present study. Individual #3 in Grade VIII was

TABLE XXXV

CERTAIN CHARACTERISTICS OF IDEALIZED INDIVIDUALS
INDIVIDUAL #3 GRADES V & VIII

GRADE V	GRADE VIII
SEX ... Male .48, Female .52	SEX ... Male .58, Female .42
AGE ..... 11.15 years	AGE ..... 13.96 years
PLACE OF RESIDENCE: Urban/Small Town/ Rural	PLACE OF RESIDENCE: Small Town>Urban* Small Town>Rural**
OCCUPATION OF BREADWINNER: Mean Socio-economic index for occupations[a] 45.96	OCCUPATION OF BREADWINNER: Mean Socio-economic index for occupations 44.64
CTMM DATA:	CTMM DATA:
i. Total IQ 106	i. Total IQ 110
ii. Language IQ 107	ii. Language IQ 111
iii. Non Language IQ ... 104	iii. Non Language IQ ... 108
iv. Verbal Comprehension 17/25	iv. Verbal Comprehension 18.7/25
v. Memory 16/25	v. Memory 18.3/25

* $p \leq .05$
** $p \leq .01$

[a] Blishen et al., 1968

found to possess a more effective and economical semantic space comprised of several dimensions of meaning using a class-membership process to identify word meaning. In Grade V, Individual #3 was shown to process words within a semantic space comprised of dimensions emphasizing the relationships among concepts and the actions associated with them. This result offered evidence of the validity of the Semantic Features Test. The test was able to differentiate between levels of semantic functioning on a qualitative basis, a function, not performed by most vocabulary tests. The cognitive behavior revealed by the test followed patterns identified through other experimental procedures, such as categorizing children's meaning responses, as well as through theoretical formulations.

The results considered in the sections above point to the practical utility of the SF Test. Subsequent to the definition of meaning spaces for individuals their personal characteristics can be identified. A response profile for each individual can also be derived to obviate the need for computer analysis of test responses. Such a response profile is presented in Appendix G for Individual #3 in Grade VIII. The test could therefore serve as a diagnostic tool. Determining the nature of semantic space for children would allow teachers to provide remedial or enrichment experiences in the light of the quality of semantic functioning revealed by this semantic space. The identification of the personal

characteristics of idealized individuals would be of value in curriculum and instruction.

SUMMARY

The multidimensional scaling program identified five dimensions for each group which were considered to be psychologically adequate in describing children's meaning space. Statistical significance of these dimensions came within acceptable limits. Dimension patterns indicated a basically similar meaning space since individual differences were largely blended together to produce a group meaning space. These dimensions proved to be bipolar. Elements within dimensions clustered at opposite ends of the plane of the dimension giving rise to a large variety of dimensions by the manner of their clustering. This characteristic of dimensions was considered to provide the flexibility in meaning necessary to account for the contextual influence upon words. Although meaning spaces for the groups were similar, a qualitative change with increasing chronological age was also evident. Dimensions identified for the Grade VIII group included more class-type strategies of signification while those of the Grade V group were indicative of a greater dependence upon the experiences of the Ss. Dimensions of the younger Ss were generally not as logically sound and consistent as those of the older Ss suggesting the inability of the Grade V Ss to organize a strategy as logically as Grade VIII Ss.

The Individual Differences Model for multidimensional scaling, by uncovering different perceptual spaces, revealed five idealized individuals in each grade. Two individuals in each grade were compared. Substantial differences were found between individuals within grades as well as between grades. As with the group model, the Grade VIII individual exhibited a more mature, logical, and economical semantic space than the Grade V individual suggesting greater efficiency and accuracy in processing words. Similar variations occurred within the grade where one individual possessed a more efficient strategy for operating upon words than did the other. The presence of class membership types of meaning dimensions was considered to reflect this kind of maturity and efficiency. These results confirmed the possibility of diagnostic application of the instrument. The identification of the dimensions of a child's meaning space would enable the teacher to provide remedial or enrichment activities for development of semantic competence.

Identification of certain personal characteristics of idealized individuals revealed something of the nature of this composite person. Those with a less adequate semantic space were younger, more likely to live in a small town, their parents were lower on the SES scale, they rated lower on measures of intellectual ability, and they may be of either sex. This kind of description may give the teacher some insight into ways of providing for individual differences.

CHAPTER VIII

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Most learning involves verbal concepts. The learner perceives his reality largely through the lens of language. He organizes these perceptions in memory through the labelling and classification they undergo when language is applied to them. How an individual perceives and processes concepts and the quality of this semantic organization will largely determine what he can learn and the way he can learn it. This study, therefore, investigated the nature of semantic processes and the concept of semantic space in order to attempt to map out the characteristics of this aspect of verbal behavior and to develop a practical objective instrument for such investigation.

The five sections of the chapter will present a brief summary of the study, the findings and conclusions, certain limitations of the investigation, some suggestions for further research, and a number of educational implications suggested by the findings.

I. SUMMARY OF THE STUDY

The study was conducted in three major phases. The first phase involved the review of literature and research to identify the kinds of semantic relations

individuals commonly perceive to exist between symbol and referent. The final list consisted of twenty-four such logico-semantic relationships. The next phase of the investigation involved the construction of a paired comparisons test based on the twenty-four categories of meaning. Two pilot studies, revisions of the test instrument, and examination of appropriate statistical treatments were also conducted. The final phase was concerned with administration of the test and the processing of data collected.

Meaning of concepts was considered to reside in the individual's semantic space. This hypothetical construct was assumed to be comprised of a number of dimensions, ways of ascribing meaningful qualities to concepts in the process of signification or labelling. These dimensions were postulated to enable the individual to process environmental stimuli and determine the quality of meaning he can attach to what he perceives. The dimensions were considered to range in power to attribute meaning from the examination of certain characteristics of concepts to the inclusion of the concept in a class of similar concepts. It was further assumed that the nature of semantic dimensions was a result of the individual's cumulative learning history where more and more complex and comprehensive "rules" about semantic relationships were developed. Conventional synonym-type tests of semantic competence were held to be largely inadequate

as the quantitative statements produced by them give no evidence of the quality of the individual's semantic behavior and thus provide little indication of the learning activities required.

The Semantic Features (SF) Test, designed to index the quality of the individual's semantic competence, consisted of 276 pairs of items. In each pair, the S was required to choose the item providing the more adequate semantic link. This procedure was assumed to reveal the kinds of meaning relations present in his semantic space. To generate the 276 pairs of items in the test, each one of the 24 categories of meaning found to be present in children's definitions of words was paired with each other one.

To provide for a form of validation of the SF Test through comparison with a standardized test of intellectual functioning as well as to provide data on the Ss in the study the California Test of Mental Maturity was used. This instrument, incorporating the construct of intellectual factors, contained verbal and non-verbal subtests.

After reliability and validity of the Semantic Features Test had been established in the pilot studies, this test along with the California Test of Mental Maturity was administered to 266 Ss in Alberta constituting a random sample of Grade V and VIII students stratified according to their place of residence in urban, small town, and rural areas.

The data collected included the Semantic Features Test results, intellectual ability as represented by performance on the California Test of Mental Maturity, population strata according to place of residence, sex, age, and socio-economic status according to the Blishen Occupational Class Scale. Data from the two tests were analyzed by selected statistical techniques including paired comparisons scaling, multidimensional scaling, factor matching, analysis of variance, computations of correlations, and principal axes factor analysis with oblique rotation. Personal data on students were used to identify the sample and describe its characteristics. The findings of these analyses are indicated in the following section.

II. FINDINGS AND CONCLUSIONS OF THE INVESTIGATION

The findings are summarized below according to the null hypotheses. Findings regarding the research hypotheses follow this summary.

Null Hypotheses

Null Hypothesis 1

There is no significant difference between grade five and eight in their response to individual items on the Semantic Features Test when compared with the responses of an adult as indicated by test means.

Statistics from the item analysis showed that the grade eight group responded significantly more like an adult could be expected to respond than did the grade five

group. The test mean of the older group was higher indicating that it had more responses in common with the adult. The variance of the two treatment groups was not significantly different indicating that there was a similar degree of variation within the groups and presumably a similar number of perceptual spaces. The hypothesis is rejected.

This result shows the influence of learning and development upon individuals' semantic behavior. However, since the test mean for both groups was low suggested that further growth in semantic competence was possible. Also suggested was the considerable variability existing in verbal behavior. It was assumed that the responses to the Semantic Features Test items of an adult, in this case a teacher in the pilot study school, would be representative of one kind of adult semantic space. Therefore, the treatment group whose responses more closely approximated those of the teacher was considered to possess a more mature kind of semantic competence. This contention was borne out in later analysis where it was found that the Grade VIII group employed a more efficient and powerful means of identifying concepts.

Null Hypothesis 2

There is no significant variation in the way the categories of meaning comprising the SF Test are used within the grades.

The Friedman Analysis of variance revealed that there was a difference in the frequency with which

individuals in each treatment group used the 24 categories of meaning comprising the Semantic Features Test. Null Hypothesis 2 is, therefore, not accepted.

Ss in each group used the meaning categories in some purposeful way, i.e., their choices were not random. That certain categories were used more than others indicated that the Ss used particular strategies in identifying words. These strategies would be comprised of certain groupings of meaning categories.

Null Hypothesis 3

There is no significant difference in the way the categories of meaning comprising the SF Test are used between grades.

The Kruskal-Wallis Analysis of Variance showed that each treatment group used certain meaning categories more frequently than the other. The null hypothesis, therefore, cannot be upheld.

In the results it was noted that the categories of meaning used more frequently by the older Ss (connotation and association) allowed a greater depth and variety of meaning due to the emotive dimension these categories identified. Also, the Grade VIII Ss used the part-part and context categories with greater frequency indicating more concern for the relationships within and between concepts than the Grade V Ss. The younger Ss used the synonym and intension categories more frequently than the older Ss did. It may appear that the greater use of these more descriptive and adequate categories should give the

younger Ss a more mature approach to meaning. This was not borne out in the multidimensional scaling. The Kruskal-Wallis analysis, which is analogous to a one-way analysis of variance, merely indicates whether the samples come from the same population for the two groups, i.e., whether one group uses these more frequently than the other. It does not indicate the relationship of one sample or variable to another.

The synonym and intension variables are similar to dictionary definitions and appear to have been more frequently chosen by the younger Ss for this feature. However, analysis by multidimensional scaling indicated that the older Grade VIII Ss had dimensions with loadings on the above noted categories together with other class-type of definitions more frequently than did the Grade V Ss. The younger Ss also used the extension and analysis categories more frequently suggesting that the Grade V Ss were more concerned with the function of the concept and its degree of familiarity to them than were the older Ss.

Null Hypothesis 4

> There is no significant correlation between the use of the categories of meaning and scores on a conventional test of vocabulary for the two treatment groups.

Computation of correlations between the frequency of use of the Semantic Features categories and the scores on the California Test of Mental Maturity, Comprehension subtest, indicated a substantial number of correlations

significant at $p \leq .05$ for both treatment groups. Accordingly, the null hypothesis is not upheld.

These correlations offered evidence relating to the validity of the SF Test. Ss use of the categories of meaning correlated to a degree with their scores on an established test of word meaning. It was apparent from the generally limited degree and the direction of correlation that the two tests measured somewhat different aspects of semantic competence. For example, the negative correlation between the synonym category in the SF Test and the Comprehension subtest (a synonym-type) of the CTMM for Grade V suggested that the synonym type of definition was not used as much by those individuals having the higher scores on the CTMM. Instead, they may seek to define words in some other, perhaps less complex, ways such as through the action categories both of which correlate positively with the Comprehension subtest. That the correlation between these same tests was positive for the Grade VIII group suggested at once a different kind of semantic behavior for the two groups of Ss as well as showing the more logical composition of their meaning space. The Grade VIII Ss were able to employ a synonym-type of definition more consistently without having to use some other form such as action.

The results also indicated a significant difference in the extent of the correlation for the two treatment groups. This evidence suggested that the quality of

semantic behavior in the older Ss was different from that in the younger. Studies have shown that an individual's intelligence tends to become differentiated with learning and maturation (Vernon)[1]. The results offered support for this position in that the decreased extent of correlations between the SF categories and the Comprehension subtest for Grade VIII showed the inability of the CTMM to detect this differentiation in verbal intellectual functioning.

Null Hypothesis 5

> There is no significant correlation between use of the categories of meaning and the scores on non-verbal tasks for the two treatment groups.

Computation of correlations between the frequency of use of the Semantic Features categories and the scores on the California Test of Mental Maturity, non-language section, indicated a small number of correlations significant at $p \leq .05$ for both treatment groups. In the two groups, 24 percent of the possible correlations were significant for the Grade V Ss and 10 percent for the Grade VIII Ss (the latter possibly due to random fluctuation). Therefore, the null hypothesis cannot be accepted.

Although the null hypothesis was not accepted, the fact that relatively few of the tests were significantly correlated, particularly for the older Ss, led the investigator to conclude that the SF Test is, for practical

[1] Available in part in The British Journal of Educational Psychology, Vol. XXXV, 1965.

purposes, not a useful measure of non-verbal competence.

This result was not unexpected. Psychologists generally accept a factorial interpretation of intellectual functioning. American psychologists explain this with the concept of partially distinct primary mental abilities while the British scholars use the concept of a hierarchical model with a general intelligence factor [g] and two main group factors; the verbal-education [v:ed] factor, and the spatial-practical [k:m] factor (Vernon). Applying the latter view to the present results, the small extent of correlation between the SF Test and the non-language section of the CTMM can be seen to result from the different nature of the tests. The CTMM non-language section appeared to measure what the British factorists have labelled spatial-practical competence while the SF Test was designed to index semantic (verbal) ability. Therefore, limited correlation is to be expected. Furthermore, the more extensive correlations between the SF Test and the language section of the CTMM contribute to evidence for the validity of the hierarchical model in describing intellectual organization as well as the validity of the SF Test generally.

General Findings and Conclusions

Findings and conclusions resulting from the facts of the investigation not stated in terms of null hypotheses are presented in this section under these main headings: factor analysis and multidimensional scaling.

Factor Analysis. The major analytical tool in this study, nonmetric multidimensional scaling, is a comparatively new technique untried in many fields of research. To examine its suitability for use in the present study, comparisons were made with results of the similar and more commonly used technique for factor analysis.

A principal axes factor analysis of the semantic category frequencies was conducted to compare results of the two programs of analysis. At the same time, factors were subjected to oblique rotation to determine whether the assumption of a Euclidian space underlying the scaling technique would satisfy the data of the present study. The oblique rotation performed upon eight varimax rotated factors in Grade V and seven in Grade VIII of the principal-axes analysis showed that most correlations between primary factors were of a low order. In all but one case, the correlations were below .50. This result was considered to confirm the suitability of the Euclidian space model for the Semantic Features Test data. It appeared that the dimensions identified by the multi-dimensional scaling programs did, in fact, represent existing relatively independent relationships and that orthogonality was not imposed upon the data by the Euclidian space model within the scaling procedure.

Of the factors identified by the principal-axes technique for each group there appeared to be five kinds

of psychologically interpretable factors for each grade. In each case two or more of the mathematical factors appeared to describe a similar sort of psychological behavior. The five factors corresponded to the results of the multidimensional scaling program. Also, the factors noted above appeared highly similar in composition to the dimensions identified through the scaling program. Therefore, since the Kruskal-Shepard nonmetric multidimensional scaling procedure was more appropriate to paired comparisons data than was conventional factor analysis, the former was used throughout the remainder of the study.

Multidimensional Scaling-Group Model. The major analysis was through a factor analytic technique, the Kruskal-Shepard nonmetric multidimensional scaling program. As with all similar programs of analysis, there are no tests of significance for factors or factor loadings. The investigator's judgement, based on his knowledge of the psychological behavior in the field of concern and the operation of the analytic technique, is the sole criterion for interpretation of data.

The Kruskal-Shepard scaling technique was applied to data generated by the entire group of Ss in each of Grades V and VIII to determine whether a qualitative change occurred in children's semantic competence as measured by the Semantic Features Test and the nature of this semantic competence at each age level. Five

dimensions were considered to describe adequately semantic behavior for each of the groups. Comparison of dimensions through the statistical procedure of factor matching showed considerable congruence between several dimensions. This result was in accord with other findings where responses have been averaged over all Ss (Messick, 1956). Examination of factors for their psychological nature revealed somewhat more substantial differences between groups.

On the basis of research hypotheses set out for this portion of the analysis the following results were noted:

Research Hypothesis 1

> Younger children, and those with less language experience, will employ simpler strategies as evidenced by higher loadings on categories of meaning having less complete and complex kinds of meaning. The converse will be true for the more mature and competent individuals.

The final configuration on five dimensions of the multidimensional scaling procedure for the two age-grade groups showed somewhat higher loadings on certain dimensions for Grade V on the categories contrast, attribute, action-of, action-upon, part-part, use-of, repetition, association, connotation, coordinate, and common-use. These were considered to define the referent less adequately than do the remaining SF categories. At the same time the Grade VIII group had somewhat higher loadings, on certain specific dimensions, on the more

adequate meaning categories such as synonym, superordinate, generic, context, and intension. However, there was no consistent pattern of higher loadings on specific categories for either group across all dimensions.

Although the pattern of loadings was not entirely as predicted it was apparent that the magnitude of loadings within specific dimensions indicated a qualitative variation in semantic behavior between groups. The younger, less experienced Ss tended to have the less adequate categories of meaning more highly correlated (having higher loadings) with their dimensions of meaning than the older Ss. The more adequate categories tended to be more important in defining meaning for the older Ss. The somewhat equivocal results in the group model can be attributed to the averaging of responses which occurs in this analytic technique. This averaging tends to reduce the variations present within the behavior of the group. As a result, differences of a small magnitude may be considered important. The research hypothesis, therefore, is accepted.

Research Hypothesis 2

Dimensions of meaning will be less logically coherent for the less mature.

The final configuration on five dimensions of the multidimensional scaling procedure for the two age-grade groups showed a greater degree of logical consistency in the dimensions of meaning identified for the older Ss.

The Grade V Ss tended to be unable to use certain categories consistently, such as the class membership categories, confounding these with other non-class-type categories as evidenced by the directionality and loading on dimensions. Grade VIII Ss, on the other hand, generally showed a more logical organization of categories in dimensions with the class-membership categories clustering together in certain dimensions on one pole of that dimension, and the action categories clustering on another pole and so on. The younger Ss appeared to be less able to organize meaning producing elements into an economical and efficient strategy than the older Ss. The research hypothesis is accepted, younger Ss have less logically coherent dimensions of meaning than the older Ss.

Research Hypothesis 3

> The more mature and competent students will display a semantic space comprised of fewer, logically more coherent dimensions than the younger students.

The finding for Research Hypothesis 2 indicated that the older Ss did indeed have logically more coherent dimensions. The multidimensional scaling technique identified the same number of dimensions in the meaning space of both groups according to the stress (goodness of fit) criterion. It was evident that, on the basis of the items in the Semantic Features Test, the meaning space of certain Ss falling within the age range 10 to 15 years can be most adequately described in five dimensions.

These dimensions differ in terms of their composition through the way in which categories load on them and the magnitude of these loadings. The research hypothesis is rejected. More mature students did not display a semantic space comprised of fewer dimensions although their dimensions were more logically constructed.

Certain general characteristics of these Ss' meaning spaces were noted. The Grade V group generally displayed less abstract and economical strategies of ascribing meaning to words than the older Ss. They examined the similarity among concepts in their own experience along with the action and function of these concepts. Concrete personal experiences and the context of concepts were important in identifying concepts with the connotative aspect of meaning also playing an important function. Where class-oriented strategies or dimensions were used they emphasized relationships between concepts as much as class membership of concepts. This confounding of strategies suggested an inability of this group to classify consistently. Relation strategies were important to these children. They examined relations between the concept and others with which it was associated along with relationships within the concept, i.e., its components. Also, the possible kinds of associations and functional relations between symbol and referent seemed to be considered. Finally, this group considered the characteristics of referents important in identifying concepts.

All dimensions displayed a bipolarity giving them a broad range of applicability. It was concluded that the bipolar nature of meaning dimensions permitted the variations in word meaning due to situational and linguistic context. This bipolarity had been previously noted in other studies of semantic behavior (Osgood, 1957).

The Grade VIII group had the more logical and psychologically sound dimensions of meaning which appeared to have the quality of being more economical and efficient in the production of meaning. These Ss considered the constituents of concepts but placed them in a generic or class setting. Dimensions employing a class membership approach to meaning were logically constituted, with all the categories loading on them being appropriate to this kind of semantic behavior. The individual's emotive reaction continued to be important in identifying concepts. Action and function characteristics of concepts remained important, being considered in class membership terms. The nature of association between and within concepts was identified by this group. Their experiences and learning became evident in the way such associations and relationships were examined. This interaction with the referent, although of a personal nature, showed evidence of being considered in a broader or class setting giving such dimensions more power in ascribing meaning to stimuli. The strategies of signification present in the semantic space of these Ss were constructed on the basis of a

bipolar organization as are those of the younger Ss.

In comparing the two processes of ascribing meaning it was noted that the major distinction between them lay in the greater efficiency of the semantic space of the Grade VIII group. This group of Ss employed the class-membership principle to a considerably greater extent than did the Grade V Ss. This result is consistent with the findings of other research into the problem of semantic behavior (Feifel and Lorge, 1950; Burns, 1960). It was noted in these studies that the most mature and efficient way of defining concepts was through identifying their class membership and determining certain differentiating characteristics. While both groups examined the characteristics of concepts, the Grade VIII group considered them within a class or generic setting to a greater degree. This finding is also consistent with theoretical views of concept development held generally by scholars as was noted in the review of literature, Chapter III.

Also distinguishing the semantic spaces of the two groups was the more adequate organization, logically and psychologically, of the Grade VIII dimensions. Categories of meaning loading on certain dimensions for this group appeared to "belong together" better than for the Grade V group.

Both groups examined the characteristics, actions and functions, and the associations between and within of

concepts. However, the older Ss once more appeared to be more logical in the kinds of semantic organization revealed in their dimensions. Also, the range in meaning, due to the bipolar nature of dimensions, was greater for the older Ss.

These findings offered support for the theoretical position taken in the study. The experimenter postulated a semantic space comprised of a number of orthogonal dimensions influenced by environmental and psychological variables. The verbal symbol would receive meaning through its location within this space, i.e., its projections upon the dimensions comprising the semantic space. These dimensions were considered to be ways of determining the meaning of concepts, e.g., contiguity and class-membership. The process of signigication, i.e., the ascribing of meaning to concepts, involved the active application of these dimensions of meaning in semantic space to verbal and other stimuli. This process, similar in function to some aspects of the orienting reaction (Berlyne, 1965), was considered to be an active search behavior by the individual resulting in the identification or definition of the stimuli, i.e., the recognition or development of a concept. Dimensions of meaning were considered to develop as a result of the individual's cumulative learning history where more and more complex structures develop out of simpler behaviors and capabilities (Gagne, 1968).

The dimensions of meaning identified for the two groups appeared to be highly independent processes of determining the relationship of a word to its referent, i.e., its meaning. This result supported the notion of a multidimensional semantic space. The qualitiative differences between the dimensions of the groups supported the notion of a cumulative development of semantic abilities arising out of learning experiences.

The commonly observed differences in semantic performance between younger and older children as well as between those of either lower intellectual competence or a deprived learning history or both and those who are more advantaged may be interpreted in the light of the above position. If children's meaning space is not well developed, their processing of stimuli will result in inferior concepts being formed in terms of their breadth and depth. Less will be known about the concepts and fewer relationships with other concepts can be established. With the development of more efficient and economical dimensions of meaning, concepts will increase in meaning and the individual's view of his reality broaden as is generally the case with learning and maturation.

The ability of the SF Test to describe certain semantic behaviors pointed to its possible use as a diagnostic instrument. Knowing the level of functioning of the individual in respect to the processing of verbal

stimuli should provide a basis for remediation or enrichment activities in his learning program.

Multidimensional Scaling - Individual Differences Model. This technique provided a separate multidimensional representation of the perceived stimulus space for each consistent viewpoint about stimuli, there being fewer consistent viewpoints than there are individuals. Representative "individuals" from the five identified for each group were examined in detail to determine their personal characteristics and compare them between and within age groups.

Substantial differences were evident between the meaning spaces of individuals from different grade groups. The dimensions identified for the Grade VIII individual showed greater complexity and adequacy than those for the Grade V individual. The Grade VIII individual had more class strategies while the Grade V individual displayed greater dependence upon his experiences with the signific ate. Dimensions showed evidence of a bipolar organization with certain categories clustering at opposite ends of dimensions. In the case of each individual, five dimensions were considered to define the meaning space most adequately.

The differences noted in the meaning space of these individuals paralleled those identified for the two groups from which these individuals were drawn although the differences were generally more gross. This result was

as expected since the group analytic model tends to reduce diversity while the individual differences model brings it out. These findings were considered to confirm the validity of the notion that semantic competence is influenced by maturation and learning.

Comparison of individuals within age-grade groups also revealed substantial differences between perceptual spaces. These findings provided support for the position taken by the investigator that semantic behavior is influenced by environmental variables such as one's social setting as well as by chronological and intellectual maturation. This evidence was supportive of the view that this type of semantic analysis might serve a diagnostic purpose.

For the two Grade V individuals examined, it was noted that one of these "composite persons" possessed greater semantic competence as evidenced by the dimensions within his semantic space. These dimensions were generally broader, allowing for the placement of concepts within a framework of greater inclusiveness making them more meaningful. This individual should be able to develop richer associations between words and significates, place concepts within larger categories, classify concepts more adequately in respect to their action and function, and relate unknown concepts to known ones rather than merely analyzing their components. His appeal to personal experience in one of the dimensions, though, suggested the

general immaturity of his meaning space in spite of it being more adequate than the semantic space of his age-mate.

In the older Grade VIII group one of the idealized individuals again possessed a more efficient strategy for processing linguistic data to arrive at meanings of words. The majority of his meaning dimensions were more economical of cognitive effort in ascribing meaning to words by identifying their class membership and more powerful in the processing of verbal stimuli by placing the words within patterns of greater inclusiveness thus providing for more associations. His dimensions examined class membership from more than one perspective, classified concepts on the basis of relations among them rather than merely looking to the context for meaning, and identified concepts through a functional classification rather than experience alone. The second individual possessed two somewhat more efficient dimensions than his age-mate although in the main, his semantic space was the less adequate of the two.

The smaller degree of variation between conceptual behavior of the older Ss may have been due to effects of schooling, the nearness of their semantic behavior to the optimum form, or the choice, in this case, of two individuals with similar characteristics. In any event it was apparent that semantic competence, as measured by the Semantic Features Test, varied both between and within age-grade groupings in accordance with results noted in

other studies as well as theoretical formulations of scholars in the field. This finding was considered indicative of the validity and the applicability of the Semantic Features Test, one of the problems to which the study was directed. Therefore, the SF Test was considered to be an instrument suitable for indexing the qualitative differences in children's vocabulary.

Personal Characteristics of Idealized Individuals

Identification of certain personal characteristics of idealized individuals revealed something of the nature of these composite persons. Those with less efficient and powerful strategies for ascribing meaning to concepts were found to be younger, more likely to live in a small town, had parents lower on the SES scale, rated lower on measures of intellectual ability, and were of either sex. This information was considered important in providing appropriate learning activities for semantic development of groups and individuals.

III. LIMITATIONS OF THE FINDINGS

Certain limitations of the investigation may restrict the application of the findings.

With respect to methodology, the Semantic Features Test may not comprise all the ways in which meaning can be ascribed to a concept. The categories of meaning constituting the test only sample the kinds of defintions

and logico-semantic relations that may be possible and the resulting semantic space was thus limited. Also, a number of the categories define the word out of context, i.e., through a single word or phrase. This removing of a word from its situational and linguistic context tends to reduce it to its essential meaning which limits uncovering of the breadth and depth of meaning of the concept. Finally, there are no tests for statistical significance of loadings on dimensions. This results in a greater degree of subjectivity in interpretation of data than might be true of a test amenable to measures of statistical significance.

The nature of the sample imposes certain limitations. The selection of only public school children from one geographical area limits the applicability of these findings to a similar population. The further restriction of the sample to children in Grades V and VIII limits the generalizability of findings to children in these grade groups.

Questions of validity of the Semantic Features Test may restrict applicability of findings. No similar test of semantic behavior was available for the purpose of comparison, therefore, evidence of construct validity has to be considered an indication of the test's validity. Further evidence of construct validity must await broader application of the instrument.

IV. IMPLICATIONS OF THE STUDY

A number of implications for the language arts program and those concerned with its orgnaization and application were suggested by the findings.

Theoretical Implications

Adequate vocabulary development in the elementary school must be based upon an appropriate model of instruction; thus the basic notions underlying this study have implications for such an instructional program. Two major factors are: (a) the multidimensionality of meaning space and the processing of verbal stimuli by these dimensions, (b) the cumulative learning view of development of semantic competence.

The notion of multidimensionality of meaning should alter the teacher's perceptions of the task of vocabulary building and the nature of the intellectual functions of which the student is capable. The processing (scanning, orienting reaction) concept has implications for verbal learning in that the goal of instruction will become one of developing strategies of manipulating concepts rather than teaching isolated words. This view will require the presence of a variety of organized experiences. The dimensions of meaning space which enable the individual to process stimuli orient him to certain relevant characteristics of these stimuli and are considered to be conditioned behaviors. They develop out of many simple

associations to form "rules" (Gagne) or strategies (Bruner) for dealing with one's environment. Development in verbal ability should, therefore, involve the learning of ways of knowing concepts rather than learning words as undifferentiated entities. The notion of cumulative learning should result in more rigorous guidelines for selecting learning activities based on hierarchical components of meaning responses.

Children's semantic competence is a function of their linguistic experiences. A child assimilates language through communication with others. This assimilation follows its own logic according to the child's circumstances and activity (El'konin in Cole and Maltzman (Eds.), 1969, p. 180). The assimilation of words restructures the sensory cognition of reality. Since words are assimilated according to orientations established towards them a child's orienting reactions determine what shall be discriminated in representing stimuli by words. In the learning situation of the school, teachers should be aware of the kinds of orientations children have towards words and seek to develop those strategies which are appropriate to the circumstances and the activity. This knowledge requires the qualitative analysis of semantic behavior according to techniques like those of the Semantic Features Test.

Conditioning new "ways of meaning" (semantic relations) to verbal stimuli should enable the child to

comprehend, i.e., solve the problem of the meaning of a word more easily. Since the materials the child reads are not words, rather concepts represented by linguistic symbols, enriching the associations a symbol may take enriches concepts and makes perception and communication more adequate. These semantic associations should be organized into broader strategies of perceiving meaning to reduce the information processing load. Thus, comprehension could be aided by developing such "anticipatory schema" or orienting reactions of imagery and language to help children orient themselves to relevant characteristics of concepts.

Vocabulary Measurement

Russell (1954, p. 317) has indicated the importance of studying the child's knowledge of concepts when measuring meaning vocabulary as well as the total size of the vocabulary and the variety of meanings in a semantic framework. His study was, therefore, concerned with investigating certain dimensions of children's meaning vocabularies; the breadth, in terms of wide ranging sampling from various subject areas, the depth, by going beyond the superficial recognition of a synonym to some measure of how much the child understands about certain words, and the height, in terms of development from year to year.

Also, he attempted to study dimensions of meaning such as from vague to clear, from concrete to abstract,

and from isolated to interrelated (Russell, 1954, p. 315). Russell employed a variety of tests to index these dimensions of meaning. The present study builds upon this position in its attempt to identify certain psychological dimensions of meaning. These dimensions were postulated to define an individual's verbal conceptual competence (semantic space) and, therefore, his knowledge of words. The Semantic Features Test indexes the individual's semantic competence providing evidence about the breadth, depth, and height dimensions in the Russell study. The satisfactory operation of the experimental test within this study, therefore, suggests its applicability to the problems of vocabulary measurement in the classroom. Also, the identification of a number of characteristic ways of perceiving concepts within a particular age-grade group indicates the test's possible diagnostic function.

Recently, attempts at determining the quality of concepts held by children have generally involved sorting Ss meaning responses into a set of a priori categories (Feifel and Lorge, 1950; Annett, 1959; and Burns, 1960). While the reliability and validity of these procedures have been established through numerous replications little effort has been expended in devising a pencil and paper test to index qualitative differences in children's vocabulary. The identification, in this research, of semantic behaviors similar to those revealed in the studies

cited above indicates the suitability of the experimental procedures employed in this study for research in verbal concept development where sorting of definitions would otherwise be applied.

The quality of meaning available to the child must be considered in terms of: (a) adequacy - the logical and representational characteristics of meaning, (b) level - the maturity of symbol-significate relationship. These aspects of meaning may be inferred from the dimensions identified in analysis of the Semantic Features Test responses. Identifying behaviors appropriate to developmental stages and situational factors would at once prevent teachers from forcing a child far beyond his competence as well as provide a guide for sequential development of semantic ability.

On the basis of a theory of meaning which holds that individuals process verbal stimuli, the dimensions of meaning within semantic space would identify these individuals' semantic competence generally. Correlating this information with evidence from various ability tests such as the California Test of Mental Maturity would enable educators to decide upon children's readiness for certain academic tasks. The categories of meaning comprising the dimensions would then provide basic guides for choosing and organizing learning activities.

In the processes of perception and signification individuals reduce the load in the cognitive processing

of data by learning appropriate strategies (Bruner, Goodnow, and Austin, 1962, p. 234). The complexity of stimuli are thereby reduced by being categorized within a limited number of dimensions which represent the whole. These dimensions of relevance are developed in the course of the individual's learning history. The measurement of semantic competence should thus take the approach where the content of words is removed leaving only the semantic link. This approach would allow the measurement of verbal ability not confined to a particular subject area. The nature of the semantic link and the process of establishing it should be identified for children at various levels to provide a basis for program development and teaching-learning activities.

Vocabulary and Cognitive Growth

Since the purpose of testing and evaluation should be the explanation and prediction of behavior which leads to its control, rather than merely the recording of performance, the language program should be concerned with the identification of the cognitive processes at work within semantic behavior. Based upon knowledge of such processes and their development a theory of instruction could be built so that learning materials and activities may be generated.

Words mediate problem solving behavior (Staats, 1963). Sequences of verbal responses constitute cognitive operations thus the nature of semantic competence should

determine the kinds of cognition and problem solving possible. Through analysis of children's semantic behavior, teachers should be able to determine the kinds of academic activities appropriate to groups and individuals.

Vocabulary for middle grade children and adolescents undergoes tremendous growth in the variety and quality of meaning associated with lexical items as these children are brought to differentiate experiences (Russell, 1954). New experiences and different subject matter produce a tremendous growth in the scope and richness (breadth) and the precision (depth) of meaning. These children, therefore, must learn to process or manipulate words in more varied and efficient ways. The strategies children use in manipulating words should be identified and appropriate learning mapped out for them to develop adequate levels of competence in the different subject areas.

Implications For the Teacher

The dimensional and developmental views of meaning and vocabulary development taken in this study (see Theoretical Implications) point to a need for a change in teacher attitude to meaning from an all-or-nothing view which holds that if the individual uses the word he is aware of all the concept can mean to one of cumulative growth in meaning based on discriminable smaller experiences. Within the notion of cumulative growth in meaning, the teacher's regular reinforcement of small learnings should lead to learner motivation and steady

development of competence. Implicit within this position is the need for the teacher to give attention to vocabulary in all subject areas to provide as many associations between word and significate as possible.

Bruner (1964) and Gagne (1968) hold that verbal competence is an important determiner of problem solving ability. It should be possible to determine the semantic organization necessary for certain cognitive behaviors such as conservation tasks. On the basis of such evidence, the nature, quality, and rigor of learning tasks in any subject area could be measured against the student's ability to manipulate ideas through words.

The quality of semantic competence, i.e., semantic space is associated with the individual's place of residence, urban, small town, or rural and SES as measured by the Blishen Occupational Class Scale. Classrooms in public schools, as a rule, contain individuals differing widely in the above noted characteristics. Teachers should, therefore, be aware of special instructional needs of children on the basis of their place of residence and SES and identify the level of semantic competence within such individuals or groups. This information would lead to appropriate ways of further developing their semantic ability as well as limiting the application of learning tasks which are inappropriate to the group's competence.

Vocabulary development should occur through the natural learning sequence for language, i.e., listening,

speaking, reading, writing. Training sessions in each mode of communication should include some analysis of the way in which verbal stimuli are processed by sender and receiver. For example, children might be asked to determine the quality (depth and breadth - Russell, 1954) of meaning of words used by the speaker or writer by comparing them with the meanings they attribute to these words on the basis of the categories of meaning in the Semantic Features Test. The children should also practice expressing ideas they have encountered by choosing words which most adequately express the qualities of concepts perceived.

The common practice in classrooms is to teach vocabulary through either one or both of the two basic approaches, i.e., the direct method (use of word lists) and the context method (reading broadly). A method arising from the evidence revealed in this study would be a synthesis of these two conventional techniques.

Using the direct approach the teacher could locate and/or develop activities wherein the child examines the ways meaning can vary and at the lowest level form many simple sensory or perceptual associations with the referent. At a higher level, these associations could be examined as to type of semantic link, e.g., attribute, contrast, action-of. Finally the child could be brought to the point where he could group meaning categories into "sets." This would enable him to see that there are

certain strategies that one may use in examining concepts in order to develop breadth and depth of meaning.

The context approach would then require the students to examine reading materials on the basis of the semantic links considered previously. Readers would then have to consider the experiences the writer wished to communicate and the means by which these were expressed.

The key point underlying this approach would be the change in the teacher's attitude towards meaning from an all or nothing ability to an evolving process based on the learner's multitudinous experiences with stimuli in the course of language development. The teacher would see that children having similar physical and intellectual characteristics could have very different levels of semantic competence as a function of their cumulative learning histories. The depth of their knowledge of concepts would, therefore, not be indicated by their recognition of words and they would require different learning experiences.

Implications For the Learner

Ausubel (1963) suggests that cognitive development occurs with greatest efficiency if organizers are introduced ahead of specifics. In vocabulary development this might take the form of presenting learning situations leading to the identification of certain strategies of ascribing meaning to concepts rather than having children memorize new words and their spelling first and learn their meanings later. Ways in which words relate to

significates would be examined, e.g., attribute, part, and class and specific words would be considered from the point of view of these relations. This would place words and concepts within systems of "organizers."

Since growth in knowledge of concepts occurs sequentially, with immediate and egocentric meaning emphasizing the learner's experiences developing first followed by a move to examination of complex characteristics and relationships of concepts leading to a class-type of organization (Annett, 1960), learning activities should follow a similar sequence. Teachers should plan activities leading from simple associations between words and referents to complex generalized logico-semantic relationships. For example, in considering the parts of speech nominals and adjectivals might be considered as expressing ideas and attributes of varying complexity while verbals and adverbals could be viewed as standing for events and qualities. The characterisitics of concepts occupying these positions within sentences could be seen to vary with the words used. The differences in quality of meaning could then be shown to result from the kinds of associations developed between word and referent.

The behavioral notion of development of meaning through learning by conditioning and the concept of verbal mediation of behavior are important in the organization of learning activities. Tasks may be analyzed into components and these learned under appropriate

conditions to produce generalized skills necessary in verbal behavior. This affords better control of learning since learning is considered to reside in the relation between the stimulus situations and behavior rather than as in an entity existing within the individual. Children should, therefore, be led to acquire a knowledge of the various kinds of semantic relations. Working from this knowledge they would be motivated to look for the most adequate symbols to express these relations. Children would then seek to establish breadth and depth of meaning, looking upon words as tools to communication. This procedure would require children to share dimensions of relevance of concepts, i.e., characteristics of the concepts rather than looking at words as undifferentiated entities.

V. SUGGESTIONS FOR FURTHER RESEARCH

Since the problem of semantic space remains to be more adequately resolved, further research should continue to investigate this area of semantic behavior.

This study should be replicated widely to provide for validation of the dimensions of meaning identified in the present research.

A study using a more complete set of logico-semantic relations should be undertaken to determine what other dimensions of meaning space may exist. Meaning space may have no optimum form, there may be a greater variety

of dimensions. It should be determined whether semantic dimensions are open-ended or exist in finite number.

Definitions used in this study did not always provide a context for the word. A study wherein words are used in context should be conducted to determine what changes in semantic space occur under the influence of situational and linguistic context.

A study to determine what experiences are associated with the development of particular dimensions of meaning should be undertaken. This information would be invaluable in the selection and organization of learning experiences.

Certain kinds of semantic competence develop at different times. The developmental sequence of these behaviors should be explored so that more appropriate learning activities can be provided.

The relation of semantic competence to academic and personal behavior should be investigated. Then educators would be aware of certain standards by which to evaluate student performance as well as having information upon the cognitive flexibility of individuals with certain semantic competencies.

A study of the effects of programs of instruction designed specifically to develop certain dimensions of semantic space would provide teachers and writers of educational materials with knowledge of the efficacy of learning experiences in semantic development.

Meaning space may take on a particular organization in adults. Adult samples should be examined to reveal the repertoires of behavior or forms of semantic organization that are possible.

The kinds of conditioning which result in children making certain choices on the Semantic Features Test could be determined. This information would provide invaluable guidance in interpreting results of analyses as well as the ways in which children mature.

Analysis of results on the basis of linguistic criteria should be conducted. The relationship of certain grammmatical characteristics of language to semantic behavior could be identified.

The Semantic Features Test should be standardized over a large student population. Answer keys and interpretations of results for all identified idealized individuals should be provided to serve as guidelines for educators, curriculum developers and writers of educational materials.

Studies should be conducted to determine the range of applicability of the test and to reveal necessary revisions to the instrument.

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APPENDIX A

THE SEMANTIC FEATURES TEST

THE SEMANTIC FEATURES TEST

NAME _____ _____
last first

GRADE _____ AGE _____ _____
years months

SCHOOL _____

TOWN STUDENT _____ COUNTRY STUDENT _____

FATHER'S OCCUPATION: _____

MOTHER'S OCCUPATION: _____

ADDRESS _____

DATE _____

SEMANTIC FEATURES TEST

Directions to the Student:

This is a test to find out how you look at the meanings of words. You will be given many pairs of statements made up of words and their meanings. These meanings will be of many different kinds. For example some words will be put together with their opposites, such as "hot - cold". Others will be matched with single words which could take their place, such as "car - automobile". Still others will be described, such as "skill - being able to do something well". There will be many other such statements. You will be asked to rank each pair of statements depending on how well you think the words on the left are described. These pairs are to be ranked by filling in the space on the answer sheet that stands for the word or statement you think is closer in meaning to the word it describes and leaving blank the space that stands for the word or statement you think is not as close. There is no one best way to answer these questions. We simply want to see what you think are the best ways of giving meanings of words. Remember you are to compare the different ways you can give meanings for words. Do not worry whether the word has a complete meaning since each word is described in a different way. Think only of the kind of meaning given for each word and choose the one which is nearer what you think the word means in each pair of statements.

Here is an example of what one ranking might look like:

TEST

1. a. ____ big - large

   b. ____ cone - like an ice-cream cone

ANSWER SHEET

1. [redacted] b

- fill in only one space for each question.

S A M P L E

You will be asked to do this test by placing marks on answer sheets. Here are some questions for you to use in practicing the marking of the answer sheets. Your teacher will check your marking.

TEST

1. a. ____ unwashed - dirty
   b. ____ yell - scream

2. a. ____ moving - stepping
   b. ____ poppy - daisy

51. a. ____ horseshoe - hard
    b. ____ rejoice - feel sad

52. a. ____ amaze - you amaze me
    b. ____ cowhide - comes from cattle

101. a. ____ satisfy - to fill the wishes of someone
     b. ____ skull - bones and skeleton

102. a. ____ travel - when you go someplace
     b. ____ better - goodness

ANSWER SHEET

1. a b	51. a b	101. a b	151. a b
2. a b	52. a b	102. a b	152. a b

1. a. ___ big - large
   b. ___ small - tiny

2. a. ___ hungry - starving
   b. ___ bird - robin

3. a. ___ fruit - apple
   b. ___ chair - table

4. a. ___ beets - peas
   b. ___ lemon - sour

5. a. ___ turtle - slow
   b. ___ hard - easy

6. a. ___ loud - soft
   b. ___ dog - bark

7. a. ___ baby - cry
   b. ___ sweep - floor

8. a. ___ throw - ball
   b. ___ bird - wing

9. a. ___ hand - finger
   b. ___ wall - floor

10. a. ___ arm - head
    b. ___ dog - bone

11. a. ___ farmer - tractor
    b. ___ orange - for eating

12. a. ___ envelope - for putting letters in
    b. ___ drink - a drink of water

13. a. ___ tap - a tap on the wall
    b. ___ apple - grows on a tree

14. a. ___ late - you can see by the clock
    b. ___ carry - heavy

15. a. ___ enjoy - fun
    b. ___ royal - strong

16. a. ___ modern - good
    b. ___ rule - to control people

17. a. ___ lengthen - make a thing longer
    b. ___ cones - from a pine

18. a. ___ bunk - it has two levels
    b. ___ bugs - beetles or flies

19. a. ___ farming - crops and animals
    b. ___ sharpen - sharpen the knife till it cuts well

20. a. ___ bitten - bitten by a snake
    b. ___ tickle - you make someone laugh

21. a. ___ selfish - all for yourself
    b. ___ scorch - burn

22. a. ___ cup - dishes
    b. ___ cone - like an ice-cream cone

23. a. ___ stool - a sort of chair
    b. ___ sipped - drank a little at a time

24. a. ___ notice - see and remember
    b. ___ steal - rob

25. a. ___ equal - same
    b. ___ vegetable - carrot

26. a. ___ good - better
    b. ___ knife - fork

27. a. ___ industry - factory
    b. ___ elephant - heavy

28. a. ___ necklace - earrings
    b. ___ wet - dry

29. a. ___ diamonds - expensive
    b. ___ hockey player - skate

30. a. ___ unhealthy - well
    b. ___ play - piano

31. a. ___ crocodile - swim
    b. ___ face - eye

32. a. ___ eat - apple
    b. ___ door - window

33. a. ___ book - page
    b. ___ cripple - crutch

34. a. ___ hand - leg
    b. ___ scissors - for cutting

35. a. ___ student - pencil
    b. ___ ring - ring the bell

36. a. ___ shotgun - for shooting
    b. ___ stove - found in a kitchen

37. a. ___ approach - approach the door
    b. ___ happen - did

38. a. ___ cartoon - found in comics
    b. ___ incorrect - bad

39. a. ___ listen - quiet
    b. ___ loosen - to make less tight

40. a. ___ immovable - strong
    b. ___ community - it has many people

41. a. ___ memorize - learn and remember something
    b. ___ seaman - ships and sailing

42. a. ___ fruit - from an orchard
    b. ___ enlarge - enlarge the hole with this shovel

43. a. ___ alphabet - A, B, C
    b. ___ unfasten - you undo something

44. a. ___ invent - invent a new machine
    b. ___ water - liquid

45. a. ___ unlock - when you open the lock
    b. ___ boar - a kind of pig

46. a. ___ pork - food
    b. ___ advice - helpful information

47. a. ___ refreshments - like something to eat
    b. ___ vacant - empty

48. a. ___ album - book for pictures
    b. ___ smile - laugh

49. a. ___ active - lively
    b. ___ sweater - jacket

50. a. ___ cool - cold
    b. ___ flame - hot

51. a. ___ animal - deer
    b. ___ hot - cold

52. a. ___ pipe - cigar
    b. ___ lion - roar

53. a. ___ whale - large
    b. ___ chew - gum

54. a. ___ strong - weak
    b. ___ shoe - heel

55. a. ___ rabbit - hop
b. ___ pedal - handlebars

56. a. ___ wash - hands
b. ___ baby - rattle

57. a. ___ tree - branch
b. ___ acid - for eating things away

58. a. ___ collar - sleeve
b. ___ believe - believe in it

59. a. ___ carpenter - nail
b. ___ comma - placed in a sentence

60. a. ___ ankle - for joining foot to leg
b. ___ prepare - ready

61. a. ___ borrow - borrow something from him
b. ___ fantastic - dangerous

62. a. ___ farmhouse - where farmer lives
b. ___ mention - talk to others about something

63. a. ___ sit - down
b. ___ airline--it has passenger planes

64. a. ___ unequal - bad
b. ___ baggage - suitcases and packages

65. a. ___ shortly - happening in a little while
b. ___ shiver - shake and shiver in the cold

66. a. ___ bait - it attracts animals
b. ___ brag - you talk about yourself

67. a. ___ furniture - chairs or tables
b. ___ basketball - game

68. a. ___ beyond - he went beyond the fence
b. ___ arctic - like the north

69. a. ___ convince - you talk a person into believing
b. ___ alphabet - set of letters

70. a. ___ perch - a fish
b. ___ adult - grown up

71. a. ___ bomber - a kind of large airplane
b. ___ damp - wet

72. a. ___ gizzard - bird's second stomach
b. ___ furniture - sofa

73. a. ___ usual - regular
b. ___ icecube - cold

74. a. ___ comfortable - very satisfied
b. ___ tall - short

75. a. ___ building - skyscraper
b. ___ cat - purr

76. a. ___ statue - painting
b. ___ eat - bread

77. a. ___ mouse - small
b. ___ bicycle - wheel

78. a. ___ old - young
b. ___ headlight - brake

79. a. ___ bandit - rob
b. ___ soldier - rifle

80. a. ___ wear - blouse
b. ___ blanket - for covering

81. a. ___ house - window
b. ___ brighten - brighten the color

82. a. ___ foot - knee
b. ___ farmyard - land surrounding a farmhouse

83. a. ___ shoemaker - boots
b. ___ belong - yours

84. a. ___ bumper - for protecting a car
b. ___ certain - good

85. a. ___ beautify - beautify the room
b. ___ amuse - make smile and laugh

86. a. ___ pianist - plays in a band
b. ___ bumper - part of car

87. a. ___ deceive - receive
b. ___ cosmetics - lipstick and powder

88. a. ___ unprotected - weak
b. ___ shrink - shrink it down to size

89. a. ___ arrest - to take prisoner for wrongdoing
b. ___ brave - when you show courage

90. a. ___ stub - part of ticket
b. ___ beetle - insect

91. a. ___ crime - stealing or killing
b. ___ dictionary - sort of a word book

92. a. ___ dock - dock the ship at the pier
b. ___ canal - man-made river

93. a. ___ drift - when you float along
b. ___ troubled - worried

94. a. ___ window - glass
b. ___ bold - very brave

95. a. ___ bulldog - a kind of dog
b. ___ farm - field

96. a. ___ grandparents - parents of parents
b. ___ oats - wheat

97. a. ___ awkward - clumsy
b. ___ deep - shallow

98. a. ___ good - expert
b. ___ hunter - shoot

99. a. ___ fish - salmon
b. ___ blow - harmonica

100. a. ___ pistol - rifle
b. ___ foot - toe

101. a. ___ plains - flat
b. ___ hoof - tail

102. a. ___ early - late
b. ___ pilot - airplanes

103. a. ___ horse - gallop
b. ___ stereo - for playing records

104. a. ___ paint - picture
b. ___ arrange - arrange all the pieces

105. a. ___ flashlight - battery
b. ___ bomb - dropped on targets in battle

106. a. ___ propeller - motor
b. ___ bitter - sour

107. a. ___ doctor - drug
b. ___ great - strong

108. a. ___ bank - for saving money
b. ___ moan - to make a low sound as in pain

109. a. ___ assemble - assemble the parts
b. ___ fishhook - it is attached to a line and rod

110. a. ___ suitcase - found in trains and planes
b. ___ merchant - buys and sells

111. a. ___ bright - light
b. ___ sneak - quietly sneak away

112. a. ___ harmless - soft
b. ___ blast - something which explodes at you

113. a. ___ combine - put things together in groups
b. ___ chisel - tool

114. a. ___ egg - from a chicken
b. ___ globe - like a ball

115. a. ___ romance - love and kisses
b. ___ glance - look at quickly

116. a. ___ soften - pound the piece to soften it
b. ___ breezy - windy

117. a. ___ vanish - you see it disappear
b. ___ trained - highly educated

118. a. ___ giraffe - animal
b. ___ planet - Mars

119. a. ___ elastic - like rubber
b. ___ ring - bracelet

120. a. ___ nostril - opening in the nose
b. ___ skeleton - brittle

121. a. ___ uncooked - raw
b. ___ insect - crawl

122. a. ___ slim - skinny
b. ___ report - news

123. a. ___ science - chemistry
b. ___ eyelid - eyelash

124. a. ___ lantern - flashlight
b. ___ fins - gills

125. a. ___ icebox - cold
b. ___ pupil - scribbler

126. a. ___ serious - funny
b. ___ camera - for taking pictures

127. a. ___ baby-sitter - watch
b. ___ attach - attach the ends together

128. a. ___ shorten - dress
b. ___ electricity - carried by wires

129. a. ___ ship - anchor
b. ___ hard - rock

130. a. ___ window - roof
b. ___ pleasing - soft

131. a. ___ baker - bread
b. ___ murmer - whisper to someone

132. a. ___ galoshes - for wearing on your feet
b. ___ sparkplug - it has to do with the motor

133. a. ___ attract - attract his attention
b. ___ sculpture - statues or stone animals

134. a. ___ scientist - works in a laboratory
b. ___ stolen - stolen by robbers from the bank

135. a. ___ high - up
b. ___ wade - you walk in the water

136. a. ___ playful - good
b. ___ cinnamon - flavoring

137. a. ___ openly - do in plain sight
b. ___ grove - like a small woods

138. a. ___ fuel - it burns in a stove
b. ___ blink - open and close eye quickly

139. a. ___ community - people and homes
b. ___ disgraceful - shameful

140. a. ___ support - it can support the weight
b. ___ jump - leap

141. a. ___ sign - you write your name
b. ___ flavoring - vanilla

142. a. ___ poplar - tree
b. ___ newspaper - magazine

143. a. ___ silvery - like silver
b. ___ peacock - colorful

144. a. ___ doughnut - small cake with hole
b. ___ splendid - awful

145. a. ___ hurriedly - speedily
b. ___ sing - song

146. a. ___ nice looking - beautiful
b. ___ body - belly

147. a. ___ footwear - slipper
b. ___ cup - bowl

148. a. ___ pencil - pen
b. ___ scientist - microscope

149. a. ___ mountain - immovable
b. ___ horse - for riding

150. a. ___ here - there
b. ___ beat - beat the others

151. a. ___ beaver - dive
b. ___ paddle - moves a canoe

152. a. ___ attack - enemy
b. ___ pleasant - happy

153. a. ___ shotgun - trigger
b. ___ disloyal - bad

154. a. ___ yolk - eggshell
b. ___ invent - develop something new

155. a. ___ logger - timber
b. ___ thunderstorm - it brings clouds and rain

156. a. ___ dice - for playing games
b. ___ dairying - milk and butter

157. a. ___ bravely - act bravely
b. ___ surrender - surrender or be caught and killed

158. a. ___ basement - goes under the house
b. ___ interfere - when you get in the way

159. a. ___ slow - turtle
b. ___ hippopotamus - animal

160. a. ___ dishonest - bad
b. ___ liquid - like water

161. a. ___ perform - to act out a part
b. ___ cider - apple juice

162. a. ___ playpen -- a baby's toys are found there
b. ___ singly - alone

163. a. ___ motor - gas and oil
b. ___ under - far below

164. a. ___ disobey - don't disobey, do as I say
b. ___ musical instrument - guitar

165. a. ___ eagerly - you act because you like it
b. ___ mosquito - fly

166. a. ___ mosquito - insect
b. ___ mystery - strange

167. a. ___ reflect - sort of give off light
b. ___ upward - downward

168. a. ___ coast - edge of land by an ocean
b. ___ housekeeper - cleans

169. a. ___ surely - definitely
b. ___ eyeglass - lens

170. a. ___ well - perfectly
b. ___ caboose - boxcar

171. a. ___ metal - gold
b. ___ sailor - ship

172. a. ___ scarf - mittens
b. ___ magnet - for picking up iron

173. a. ___ swamp - wet
b. ___ often - too often is too much

174. a. ___ somewhere - nowhere
b. ___ pebble - found lying on the ground

175. a. ___ blade - cut
b. ___ safely - home

176. a. ___ love - friends
b. ___ unafraid - good

177. a. ___ broom - handle
b. ___ practice - do again and again

178. a. ___ lung - heart
b. ___ cookbook - it has many recipes

179. a. ___ waiter - menu
b. ___ jewel - diamond or ruby

180. a. ___ saw - for cutting
b. ___ thicken - thicken the gravy by adding more flour

181. a. ___ quote - quote the words
b. ___ perform - when you do something

182. a. ___ train - runs on rails
b. ___ mushroom - plant

183. a. ___ obey - yes
b. ___ memorize - sort of learn

184. a. ___ unborn - soft
b. ___ brand - special mark

185. a. ___ pretend - make-believe that something is real
b. ___ hard - difficult

186. a. ___ musician - he has an instrument
b. ___ gradually - at once

187. a. ___ jewelry - rings and bracelets
b. ___ human - boy

188. a. ___ through - it went through the window
b. ___ comma - period

189. a. ___ upstairs - when you climb the stairs
b. ___ germ - invisible

190. a. ___ pamphlet - book
b. ___ first - last

191. a. ___ lodge - like another home
b. ___ children - play

192. a. ___ aspirin - drug for curing headaches
b. ___ roam - road

193. a. ___ sadly - unhappily
b. ___ burner - oven

194. a. ___ idly - lazily
b. ___ jeweler - ring

195. a. ___ grandparents - grandfather
b. ___ eyeglass - for helping to see better

196. a. ___ red - green
b. ___ mash - mash it down

197. a. ___ cartoon - funny
b. ___ mathematics - working with numbers

198. a. ___ longer - shorter
b. ___ sadly - tear

199. a. ___ pickpocket - steal
b. ___ uncertain - weak

200. a. ___ celebrate - birthday
b. ___ earning - working to make money

201. a. ___ book - chapter
b. ___ shampoo - it has suds

202. a. ___ bulb - switch
b. ___ business - stores and garages

203. a. ___ thinker - ideas
b. ___ trample - crush and trample the grass down

204. a. ___ suitcase - for travelling
b. ___ elect - when you choose by voting

205. a. ___ begin - begin at the beginning
b. ___ moth - insect

206. a. ___ dock - where ship ties up
b. ___ grin - a kind of smile

207. a. ___ usually - quickly
b. ___ beaver - small furred animal

208. a. ___ confess - good
b. ___ again - once more

209. a. ___ refund - return money
b. ___ great - excellent

210. a. ___ education - it needs schools and teachers
b. ___ crowd - man

211. a. ___ juggle - toss and flip
b. ___ oranges - apples

212. a. ___ cheaply - buying cheaply saves money
b. ___ arctic - cold

213. a. ___ wander - you walk here and there
b. ___ excellent - terrible

214. a. ___ apple - fruit
b. ___ cripple - limp

215. a. ___ clam - a kind of shellfish
b. ___ rejoin - group

216. a. ___ bomb - explosive material
b. ___ grain - oats

217. a. ___ whole - complete
b. ___ postmaster - mail

218. a. ___ often - hourly
b. ___ multiplication - for use in arithmetic

219. a. ___ flower - rose
b. ___ blind - a blind person

220. a. ___ breakfast - supper
b. ___ here - in this place

221. a. ___ hail - cold
b. ___ believe - tell

222. a. ___ later - earlier
b. ___ unexpected - good

223. a. ___ borrower - ask
b. ___ order - tell others to obey

224. a. ___ test - skills
b. ___ grain - from fields of crops

225. a. ___ violet - petal
b. ___ appearance - face and clothing

226. a. ___ trigger - barrel
b. ___ attack - soldiers attack the enemy

227. a. ___ plumber - wrench
b. ___ frequently - you do it often

228. a. ___ spool - for winding thread on
b. ___ oyster - shellfish

229. a. ___ blond - a blond girl
b. ___ jigsaw - a kind of puzzle

230. a. ___ iceberg - floats in the ocean
b. ___ bloodhound - breed of dog

231. a. ___ gleam - bright
b. ___ frequently - often

232. a. ___ unclean - bad
b. ___ long - stretched out

233. a. ___ outstanding - important work
b. ___ dog - collie

234. a. ___ knife - it has a blade
b. ___ cap - hat

235. a. ___ flavoring - vanilla and strawberry
b. ___ cliff - rocky

236. a. ___ finally - at last he finally went
b. ___ perfectly - poorly

237. a. ___ completely - you finish your work
b. ___ fire - burn

238. a. ___ daffodil - flower
b. ___ graze - grass

239. a. ___ rodeo - a kind of contest
b. ___ stream - rapids

240. a. ___ whisper - soft sound
b. ___ engine - boxcar

241. a. ___ seldom - not often
b. ___ shingles - for covering a roof

242. a. ___ trot - gallop
b. ___ bloody - a bloody knife

243. a. ___ direction - south
b. ___ branch - where the river divides

244. a. ___ doughnut - muffin
b. ___ crazily - dance

245. a. ___ liguid - wet
b. ___ unexplored - dangerous

246. a. ___ sooner - later
b. ___ quit - to stop

247. a. ___ stream - gurgle
b. ___ cobweb - from a spider

248. a. ___ crack - egg
b. ___ mine - dig and burrow

249. a. ___ envelope - flap
b. ___ forward - moving forward he advanced

250. a. ___ page - cover
b. ___ yawn - you open your mouth sleepily

251. a. ___ Indian - tomahawk
b. ___ submarine - ship

252. a. ___ blotter - for drying ink
b. ___ speedily-- sort of quickly

253. a. ___ bold - a bold man
b. ___ garage - a building for cars

254. a. ___ bracelet - hangs at the wrist
b. ___ cheerfully - happily

255. a. ___ swift - fast
b. ___ soon - immediately

256. a. ___ love - good
b. ___ dessert - pie

257. a. ___ roam - to wander about
b. ___ shoes - boots

258. a. ___ iceberg - from a glacier
b. ___ cracker - crisp

259. a. ___ skeleton - bones and skull
b. ___ singly - as a group

260. a. ___ generally - generally it is so
b. ___ dice - roll

261. a. ___ sometimes - you do it now and then
b. ___ bake - bread

262. a. ___ grizzly - bear
b. ___ triangle - angle

263. a. ___ horsefly - sort of a large fly
b. ___ handle - spout

264. a. ___ lullaby - song for putting a baby to sleep
b. ___ banker - money

265. a. ___ gradually - slowly
b. ___ brand-new - a brand-new car

266. a. ___ badly - terribly
b. ___ sliver - sticks in your finger

267. a. ___ game - football
b. ___ thirsty - hungry

268. a. ___ bulldog - husky
b. ___ unkind - hard

269. a. ___ runway - long
b. ___ sufficiently - having done enough

270. a. ___ silently - noisily
b. ___ cider - from apples

271. a. ___ antelope - leap
b. ___ boating - sailing or rowing

272. a. ___ borrow - money
b. ___ boost - boost it up to the top

273. a. ___ album - picture
b. ___ gladly - you do something because you want to

274. a. ___ pocket - button
b. ___ vest - suit

275. a. ___ teacher - chalk
b. ___ opera - a kind of music

276. a. ___ ambulance - for carrying sick people
b. ___ lumber - wood for building

APPENDIX B

EXAMINER'S MANUAL

THE SEMANTIC FEATURES TEST

PART I TEST MATERIALS -
CHILDREN'S MEANING CATEGORIES

PART II DIRECTIONS FOR ADMINISTRATION

EXAMINER'S MANUAL

THE SEMANTIC FEATURES TEST

by

Peter O. Evanechko

PART I

TEST MATERIALS

Two hundred seventy-six pairs of pairs or sets of logico-semantic relationships will be presented for ranking by the Ss. These sets represent the pairing of each of the 24 semantic relationships found to exist in children's cognitive behavior with every other relationship. The task of the Ss will be to rank the items in the sets in terms of their importance to them for achieving meaning of a verbal stimulus.

Children's Meaning Categories

1. Synonym. The members of each word pair have exactly or very nearly the same referent:

   e.g. big - large
   steal - rob

2. Similarity. The members of each word pair are similar through being aligned on some dimension, with the referent of the right-hand member occupying a more extreme position on this dimension:

   e.g. small - tiny
   hungry - starving

3. Superordinate. The left-hand member denotes a common class of which the right-hand concept is a member:

   e.g. bird - sparrow
   fruit - apple

4. Coordinate. The members of each pair refer to familiar members of a familiar class:

   e.g. chair - table
   beets - peas

5. Attribute. The right-hand member of each pair refers to a quality or attribute generally recognized as characterizing the object denoted by the left-hand member:

   e.g. lemon - sour
   turtle - slow

6. Contrast. The members of each word pair refer to opposite ends of a continuum:

e.g. hard - easy
loud - soft

7. Action-of. The right-hand member of each pair is an intransitive verb denoting concrete action associated with and performed by the agent referred to by the left-hand member:

e.g. dog - bark
baby - cry

8. Action-upon. The left-hand member of each pair is a transitive verb denoting a concrete action associated with and performed upon the object referred to by the right-hand member:

e.g. sweep - floor
throw - ball

9. Whole-part. The right-hand member of each pair refers to a familiar object recognized as an important part of a familiar whole denoted by the left-hand member:

e.g. bird - wing
hand - finger

10. Part-part. The members of each pair refer to familiar objects which are parts of a familiar whole:

e.g. wall - floor
arm - head

11. Common use. The right-hand member of each pair denotes an object associated with and acted upon by the agent referred to by the left-hand member:

e.g. farmer - tractor
dog - bone

12. Use of. The right-hand member of each unit denotes a use made of the left-hand member:

e.g. orange - for eating
envelope - for putting letters in

13. Repetition. The right-hand member of each unit is a repetition of the concept referred to by the left-hand member:

e.g. drink - a drink of water
tap - a tap on the wall

14. Contiguity. The left-hand member of the unit is defined by direct concrete interaction of place, time or activity with the right-hand member:

e.g. apple - grows on a tree
late - you can see by the clock

15. Free association. The members of the unit are free associates:

e.g. carry - heavy
enjoy - fun

16. Connotation. The right-hand member of each pair connotes a relationship with the left-hand member:

e.g. royal - strong
modern - good

17. Analysis. The right-hand member is an analysis of the left-hand member indicating certain dimensions of function of this concept:

e.g. rule - to control people
lengthen - make a thing longer

18. Synthesis. The right-hand member defines the left-hand member by stating its relation with other concepts commonly associated with it:

e.g. acorns - from an oak tree
bunk - it has two levels

19. Extension of a class (Implication). The right-hand member of the unit gives examples of concepts to which the left-hand member might refer implying a degree of familiarity with the concept:

e.g. bugs - insects and flies
farming - crops and animals

20. Denotation in Context. The left-hand member is defined by use in context:

e.g. sharpen - sharpen the knife till it cuts well
bitten - bitten by a snake

21. Ostensive Definition. The right-hand member defines the left-hand member largely on the basis of experience:

e.g. tickle - you make someone laugh
selfish - all for yourself

22. Generic Definitions. The right-hand member denotes the common class to which the left-hand member belongs:

e.g. kindle - burn
cup - dinnerware

23. Class membership implied. The right-hand phrase attempts to bridge the gap between general and specific by using phrases such as "a kind of," "sort of" or "like a":

e.g. cone - like an ice-cream cone
stool - like a chair

24. Intension of a class (Genus et Differentia). The right-hand member states the class as well as the distinguishing features of the left-hand member:

e.g. sipped - drank a little at a time
notice - see and remember

PART II

DIRECTIONS FOR ADMINISTRATION

This test is an experimental form of a vocabulary measure suitable for use at the upper elementary and secondary levels. The purpose of the test is to provide data on the student's ability to perceive and use certain kinds of semantic relationships. The nature and quality of these relationships will serve as an index of the quality of meaning and therefore the level of cognitive functioning the individual may achieve. It is, therefore, important that students respond naturally to the test, i.e., a normal classroom atmosphere be maintained. Students should be encouraged to work carefully but not to deliberate at length over the "best" response since there is no single best way of making the choices and it is the students' own reactions that are important. Also, the subjects should not be made to feel that this is a "final" examination or one which will determine their class standing but rather a diagnostic test to determine their competence in vocabulary.

Time Limits

There is no time limit for this instrument since it is not a speed test although all students should be able to complete the test within one hour. The total testing time may be broken up into one-half hour periods for elementary students and forty-five minute periods for secondary students. It is important that the subjects not be rushed and that they respond to every item.

Preparation For the Test

Before presenting the Semantic Features Test the examiner should become familiar with the test content and the marking of the answer sheets. The best preparation will be for the examiner to do part of the test while rehearsing the test situation.

It is equally important that all examinees be familiar with the nature of the test and the method used for marking test responses. A sample exercise is provided in the test booklet for this purpose and should be used and carefully discussed prior to the administration of the test. The accompanying IBM answer sheets should be carefully examined and their use indicated.

Testing Cautions

1. Marking IBM Answer Sheets. The examiner should note the instructions for use of these forms which are printed at the top of the sheet and be sure that students are fully aware of these instructions. It is particularly important that an HB pencil be used, that all marks are placed carefully between the guidelines and that no stray marks are made. Only one blank should be filled for each item and erasures should be done so that no mark remains for the electronic scoring machine to sense.

Students should be instructed to fill in the identification blanks at the top of each answer sheet as well as on the test booklet.

Care should be taken not to mutilate the answer sheets and upon completion of the test, the sheets should be placed within the test booklet and turned in to the examiner.

2. Caution Against Coaching. In order to encourage the best performance from a test group, the examiner should be sure that all students understand clearly what they are to do and the manner in which they are to record their responses. In assisting them, however, the examiner must remember that this is a testing situation and in no way should assistance with responses be given for any items except the samples. Assistance with mechanical acts such as finding the right number are quite permissable.

3. Irregularities During Testing. Testing may be invalidated by unforseen irregularities. It is recommended that the examiner note in writing irregularities in the test situation involving individual pupils or the group as a whole.

4. Completion of the Test. In forced-choice tests, such as this, it is essential that the students respond to all items in order that each item is ranked an equal number of times. Thus, the examiner should make sure that subjects do not leave out questions. The examinees may be reminded during the course of the examination that it is their own reaction that is required and that they should differentiate between each pair of items applying their own criteria.

5. Effect of Test Format. The forced-choice ranking format of the test may be quite new to the students, thus the examiner should familiarize the examinees with it to avoid confusion among subjects. Furthermore, the fact that there is no keyed correct response should be emphasized.

APPENDIX C

AHMAVAARA FACTOR MATCH FOR PILOT STUDY ON THE SEMANTIC FEATURES TEST

A. GROUP MODEL

B. CROSS VALIDATION

AHMAVAARA FACTOR MATCH FOR PILOT STUDY
ON THE SEMANTIC FEATURES TEST

A. GROUP MODEL

GRADE 4-5 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.7266	0.0601	0.4893	0.3417	-0.2895	0.1686
2	0.0541	0.9894	0.1176	-0.0638	0.0007	-0.0152
3	0.1220	0.0110	0.9393	0.2121	0.1613	0.1778
4	0.1612	0.1157	-0.2151	0.9339	0.1796	0.0995
5	0.0372	0.2900	-0.0757	0.1946	0.9234	-0.1353
6	-0.0857	-0.0933	0.1613	0.2246	0.2121	0.9287

GRADE 4-6 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.9834	-0.0322	-0.0569	0.0323	0.1523	-0.0663
2	0.1190	0.6875	0.3614	0.4177	0.3581	-0.2825
3	0.0905	0.3931	0.8415	0.1206	0.1972	0.2752
4	0.0673	0.0321	0.4045	0.8080	-0.2505	0.3393
5	0.0795	0.3790	0.0788	-0.5155	0.7539	0.0982
6	-0.2799	0.0676	0.1552	0.4760	0.1691	0.7987

GRADE 5-6 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.9270	-0.0008	0.2308	-0.1022	0.0102	0.2773
2	0.3032	0.8443	0.2468	0.2549	0.2373	-0.1141
3	0.3167	0.0340	0.9253	0.0119	0.1800	-0.0994
4	0.1812	0.6388	0.0349	0.7045	-0.2220	0.1113
5	-0.2226	0.3573	0.4227	-0.4366	0.6123	0.2802
6	0.0327	0.0430	-0.1822	0.4237	0.0854	0.8815

AHMAVAARA FACTOR MATCH FOR PILOT STUDY
ON THE SEMANTIC FEATURES TEST

B. CROSS VALIDATION
GRADE 4-4 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.7951	0.3523	-0.1925	-0.0543	0.3398	-0.2971
2	-0.0091	0.8184	-0.3791	0.1153	-0.3204	0.2655
3	-0.4561	-0.3384	0.7548	0.3230	-0.0061	0.0588
4	-0.2865	0.1929	0.3967	0.6537	-0.1380	0.5262
5	0.0421	-0.1311	-0.3969	0.2592	0.8695	0.0152
6	-0.0620	0.2813	0.2028	-0.1130	0.0227	0.9288

GRADE 4-5 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.7972	-0.4686	0.2284	0.1296	-0.0600	0.2688
2	0.4161	0.7846	0.4116	-0.0889	0.1279	0.1323
3	-0.1548	-0.1833	0.9150	0.2486	-0.2040	0.0419
4	-0.3954	-0.7021	0.0159	0.4848	-0.3320	-0.0714
5	0.2856	-0.2149	-0.3105	-0.2589	0.8093	-0.2318
6	-0.6092	0.2018	0.0839	0.0385	0.3929	0.6521

GRADE 4-6 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.6160	0.1407	0.0039	-0.2515	0.3783	0.6280
2	-0.2355	0.8593	0.0087	-0.0291	-0.3420	0.2971
3	-0.3741	0.0153	0.8589	-0.1664	0.0027	0.3071
4	-0.1578	-0.1213	0.0776	0.9422	-0.2463	-0.0770
5	-0.1044	-0.0590	0.2651	0.1985	0.9021	0.2494
6	0.1552	0.4507	-0.0597	0.2334	0.3111	0.7861

AHMAVAARA FACTOR MATCH FOR PILOT STUDY
ON THE SEMANTIC FEATURES TEST

B. CROSS VALIDATION (CONTINUED)

GRADE 5-5 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.6331	-0.2325	0.0551	0.6231	-0.3708	0.1279
2	-0.0394	0.2510	0.9346	0.0413	-0.0214	0.2444
3	0.2144	0.3183	0.6652	-0.5203	-0.3251	0.1839
4	-0.1637	0.5814	-0.1094	0.2431	0.1068	0.7434
5	-0.0732	0.2911	-0.3185	0.3603	0.8149	0.1204
6	0.0939	-0.1645	0.4104	0.1223	0.4080	0.7838

GRADE 5-6 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.6900	-0.1817	0.2773	-0.1565	0.4800	0.3989
2	-0.5697	0.5102	-0.4302	0.4142	0.0347	0.2392
3	0.5973	0.7000	0.3517	-0.0936	-0.1370	-0.0443
4	0.3107	0.0911	0.0921	0.5443	0.7205	0.2672
5	0.7296	-0.0879	0.3284	0.2168	0.4081	0.3722
6	0.4578	-0.0919	-0.0917	0.5284	0.0510	0.7013

GRADE 6-6 COMPARISON MATRIX L

	1	2	3	4	5	6
1	0.8901	0.0614	-0.2972	-0.2844	-0.1130	0.1481
2	0.2373	0.8581	0.3413	0.1812	-0.2378	-0.0382
3	-0.3815	0.4770	0.1481	0.2103	-0.5451	0.5135
4	0.0415	0.2954	-0.3694	0.7223	0.3737	-0.3364
5	0.1794	0.0911	-0.3696	0.2111	0.8819	0.0232
6	-0.1340	0.4826	-0.1008	-0.0488	-0.0501	0.8568

APPENDIX D

LOADINGS ON FINAL CONFIGURATION

IN 5 DIMENSIONS

FOR THE SEMANTIC FEATURES TEST

GRADE V

GRADE VIII

LOADINGS ON FINAL CONFIGURATION IN 5 DIMENSIONS
FOR THE SEMANTIC FEATURES TEST - GRADE V

	1	2	3	4	5
1	0.599	-0.449	-0.477	-0.410	-0.185
2	-0.853	-0.113	0.319	-0.126	-0.308
3	-0.331	-0.855	0.088	-0.348	0.164
4	-0.400	-0.343	-0.221	0.583	-0.540
5	0.069	0.422	0.063	-0.655	0.604
6	-0.091	-0.191	-0.570	-0.216	-0.724
7	-0.734	0.093	-0.613	0.154	0.153
8	0.745	0.101	-0.174	0.251	-0.601
9	0.270	0.455	-0.813	0.122	0.195
10	0.246	0.403	0.752	-0.264	-0.274
11	0.076	0.265	0.288	0.733	-0.486
12	-0.296	-0.238	0.276	0.005	0.917
13	0.479	-0.343	0.691	0.322	0.248
14	-0.428	0.063	-0.138	-0.095	-0.069
15	0.733	-0.053	-0.138	0.245	0.608
16	-0.061	0.783	-0.317	-0.317	-0.676
17	-0.105	-0.413	0.697	-0.210	-0.638
18	-0.109	-0.018	-0.255	0.929	0.382
19	-0.043	-0.332	-0.653	-0.181	0.647
20	-0.555	0.758	0.072	0.086	0.051
21	0.219	-0.848	-0.026	0.425	-0.053
22	0.562	-0.154	0.302	-0.740	0.002
23	0.446	0.819	0.123	0.178	0.195
24	-0.437	0.186	0.724	0.341	0.390

LOADINGS ON FINAL CONFIGURATION IN 5 DIMENSIONS
FOR THE SEMANTIC FEATURES TEST - GRADE VIII

	1	2	3	4	5
1	-0.072	-0.864	-0.439	0.137	0.033
2	-0.667	-0.024	-0.210	-0.698	-0.020
3	0.140	-0.248	0.627	-0.716	-0.123
4	-0.507	-0.008	-0.519	0.614	-0.078
5	0.236	-0.361	-0.526	-0.691	0.161
6	-0.206	0.027	-0.517	-0.327	-0.729
7	-0.725	0.403	-0.322	0.016	0.501
8	0.402	0.182	-0.843	0.186	-0.280
9	0.529	0.622	-0.052	-0.251	-0.475
10	-0.815	-0.597	0.319	-0.076	-0.020
11	0.193	0.316	0.505	0.420	-0.565
12	-0.154	-0.027	0.443	0.606	0.618
13	0.115	0.546	0.038	-0.715	0.315
14	0.044	-0.396	0.265	-0.218	-0.838
15	0.792	-0.590	-0.057	-0.078	-0.268
16	-0.528	0.749	-0.033	0.322	-0.567
17	0.302	-0.318	0.903	0.248	0.161
18	0.531	-0.148	-0.342	0.767	0.188
19	-0.119	-0.499	0.050	-0.126	0.872
20	-0.268	-0.393	0.241	0.702	-0.380
21	0.270	0.212	-0.569	-0.116	0.712
22	0.851	0.138	0.228	-0.074	0.352
23	0.085	0.816	0.069	0.398	0.333
24	-0.429	0.463	0.742	-0.328	0.098

APPENDIX E

PRINCIPAL AXES FACTOR ANALYSIS

FACTOR LOADINGS AND COMMUNALITIES

FOR THE SEMANTIC FEATURES TEST

GRADE V

GRADE VIII

VARIMAX ROTATED FACTOR LOADINGS AND COMMUNALITIES
FOR THE 24 VARIABLES OF THE SEMANTIC FEATURES TEST
GRADE V

	COMMUNALITIES	1	2	3
1	0.725	-0.624	0.155	-0.388
2	0.717	-0.045	0.024	-0.020
3	0.650	0.616	0.331	-0.144
4	0.628	0.121	-0.458	-0.184
5	0.774	0.059	0.145	-0.089
6	0.727	-0.038	-0.709	-0.169
7	0.594	0.020	0.009	-0.085
8	0.464	0.594	-0.188	-0.092
9	0.495	0.155	-0.202	-0.285
10	0.555	0.357	-0.590	-0.210
11	0.611	0.382	-0.220	0.196
12	0.631	-0.496	0.246	0.401
13	0.701	0.123	-0.095	-0.149
14	0.719	-0.144	0.120	0.821
15	0.531	0.227	-0.052	-0.386
16	0.670	0.675	-0.071	-0.279
17	0.632	-0.556	0.215	0.036
18	0.531	-0.178	0.384	0.571
19	0.751	-0.006	0.090	0.413
20	0.662	-0.082	0.133	0.190
21	0.646	-0.272	0.670	0.139
22	0.717	0.064	-0.130	-0.129
23	0.497	-0.227	0.416	-0.065
24	0.658	-0.699	0.323	0.201
PERCENT OF TOTAL VARIANCE				
		63.693	13.312	9.971	8.833

GRADE V (continued)

	4	5	6	7	8
1	0.010	0.271	0.010	-0.297	0.003
2	-0.077	-0.097	0.828	-0.095	-0.061
3	0.189	0.073	-0.240	-0.193	0.069
4	0.350	-0.099	0.194	-0.109	0.434
5	0.068	0.288	-0.095	0.786	-0.165
6	0.163	-0.250	-0.253	-0.166	-0.118
7	0.072	0.751	-0.014	0.126	-0.042
8	0.101	0.151	0.089	0.127	0.103
9	0.302	0.160	0.141	0.053	0.457
10	-0.081	-0.032	0.078	0.039	0.143
11	0.081	0.250	-0.116	0.426	0.337
12	0.155	-0.360	0.006	0.097	-0.026
13	-0.798	-0.000	0.104	-0.077	0.027
14	-0.043	-0.012	0.019	-0.088	-0.013
15	0.151	0.216	0.438	0.256	-0.016
16	-0.069	-0.248	0.154	0.061	-0.197
17	0.008	-0.367	-0.363	-0.085	0.034
18	-0.059	-0.100	-0.063	-0.066	0.063
19	0.137	0.300	-0.293	-0.604	-0.113
20	-0.768	-0.082	-0.053	0.045	0.033
21	0.058	-0.286	-0.133	-0.041	-0.006
22	0.212	0.125	0.183	0.071	-0.762
23	-0.147	-0.252	-0.399	-0.153	0.025
24	0.112	-0.078	0.027	0.013	-0.073
	7.084	6.517	6.512	6.298	5.167

VARIMAX ROTATED FACTOR LOADINGS AND COMMUNALITIES
FOR THE 24 VARIABLES OF THE SEMANTIC FEATURES TEST
GRADE VIII

	COMMUNALITIES	1	2	3
1	0.705	0.465	0.114	0.618
2	0.501	0.094	0.219	0.106
3	0.681	-0.073	-0.251	-0.074
4	0.663	-0.734	-0.186	0.165
5	0.641	-0.060	0.083	0.089
6	0.689	-0.658	0.102	0.311
7	0.691	0.190	-0.283	0.073
8	0.578	-0.160	-0.723	-0.083
9	0.474	-0.300	-0.494	0.007
10	0.659	-0.732	-0.297	0.014
11	0.553	-0.104	-0.591	-0.025
12	0.623	0.411	0.339	0.045
13	0.798	0.123	-0.055	-0.859
14	0.634	0.124	0.192	-0.219
15	0.603	-0.101	-0.114	0.041
16	0.581	-0.220	-0.106	-0.356
17	0.646	0.541	0.295	0.109
18	0.539	0.078	0.301	-0.152
19	0.665	0.260	0.110	0.302
20	0.773	0.297	0.101	-0.746
21	0.614	0.620	0.106	0.064
22	0.740	-0.069	0.290	0.371
23	0.655	0.184	0.688	-0.007
24	0.606	0.444	0.271	0.333
PERCENT OF TOTAL VARIANCE				
		63.810	13.489	10.341	9.980

GRADE VIII (continued)

	4	5	6	7
1	-0.006	-0.121	-0.035	-0.280
2	0.615	0.031	-0.116	-0.200
3	0.060	-0.044	0.774	0.044
4	0.049	-0.236	0.024	-0.059
5	0.152	0.771	-0.072	0.017
6	0.026	-0.048	-0.271	-0.269
7	-0.000	0.751	0.075	-0.010
8	0.096	0.066	0.027	-0.090
9	-0.132	-0.052	0.226	-0.261
10	0.056	-0.079	0.041	-0.156
11	-0.245	0.335	0.087	-0.107
12	-0.106	0.001	-0.296	0.489
13	0.013	-0.095	-0.177	0.044
14	-0.326	0.125	-0.099	0.635
15	0.739	0.132	0.036	0.117
16	0.564	0.108	0.188	-0.171
17	-0.162	-0.376	-0.294	0.003
18	-0.518	0.055	-0.190	0.335
19	-0.011	-0.231	0.182	0.639
20	-0.201	-0.152	0.064	-0.225
21	-0.063	-0.307	-0.321	0.111
22	0.011	0.109	0.699	-0.116
23	-0.371	-0.042	0.083	0.038
24	-0.132	-0.380	-0.210	0.136
	8.222	7.858	7.203	6.717

APPENDIX F

LOADINGS ON FINAL CONFIGURATION IN 5 DIMENSIONS FOR THE SEMANTIC FEATURES TEST

GRADE V - INDIVIDUAL #1

- INDIVIDUAL #3

GRADE VIII - INDIVIDUAL #1

- INDIVIDUAL #3

LOADINGS ON FINAL CONFIGURATION IN 5 DIMENSIONS
FOR THE SEMANTIC FEATURES TEST - GRADE V INDIVIDUAL #1

	1	2	3	4	5
1	0.277	-0.904	-0.282	0.041	-0.112
2	-0.189	0.223	-0.430	-0.661	-0.431
3	-0.075	-0.555	0.120	-0.828	0.125
4	-0.436	-0.297	0.501	0.558	-0.348
5	-0.092	0.432	-0.445	-0.574	0.480
6	-0.148	-0.384	-0.342	-0.064	-0.802
7	-0.248	0.340	-0.862	0.233	-0.063
8	0.894	0.199	0.068	0.410	-0.018
9	0.025	0.483	-0.138	0.245	0.793
10	-0.006	0.624	0.475	0.690	0.097
11	0.123	-0.005	-0.168	0.688	-0.671
12	-0.346	-0.606	-0.042	0.189	0.696
13	0.368	0.591	0.452	-0.464	0.191
14	-0.819	-0.175	0.312	-0.473	0.126
15	0.649	-0.058	-0.751	-0.154	0.087
16	-0.786	0.759	0.133	0.037	-0.088
17	-0.199	0.008	0.608	-0.304	-0.674
18	0.057	-0.260	-0.346	0.867	0.324
19	0.470	-0.158	0.002	-0.248	0.847
20	-0.826	-0.261	-0.420	0.194	0.012
21	0.479	-0.531	0.612	0.188	-0.091
22	0.671	-0.127	0.117	-0.621	-0.365
23	0.250	0.774	-0.078	0.016	-0.581
24	-0.094	-0.012	0.904	0.036	0.466

LOADINGS ON FINAL CONFIGURATION IN 5 DIMENSIONS
FOR THE SEMANTIC FEATURES TEST - GRADE V INDIVIDUAL #3

	1	2	3	4	5
1	0.926	-0.218	-0.152	0.150	0.046
2	-0.519	0.801	-0.066	-0.055	0.191
3	-0.688	-0.391	0.283	-0.522	-0.148
4	-0.113	-0.315	-0.530	0.652	0.395
5	0.033	-0.333	-0.654	-0.585	-0.299
6	-0.514	0.235	0.123	0.051	-0.810
7	-0.781	-0.025	-0.618	0.019	-0.129
8	0.482	0.009	-0.364	-0.015	-0.777
9	-0.132	0.414	0.159	-0.781	-0.377
10	0.266	-0.264	0.592	0.178	-0.715
11	-0.078	0.354	-0.335	0.774	-0.345
12	0.046	0.335	0.134	0.473	0.851
13	0.489	-0.242	0.289	-0.711	-0.157
14	-0.623	-0.048	0.318	-0.294	0.696
15	0.541	0.202	0.368	0.707	0.009
16	0.260	0.630	-0.873	0.017	-0.102
17	0.228	-0.114	0.878	-0.265	0.345
18	-0.282	-0.608	0.217	0.690	-0.168
19	0.278	-0.727	0.145	0.049	0.610
20	-0.114	-0.156	-0.582	-0.304	0.684
21	-0.031	-0.955	-0.197	-0.083	-0.237
22	0.438	0.425	-0.184	-0.538	0.542
23	0.405	0.820	0.303	-0.018	-0.163
24	-0.518	0.172	0.745	0.402	0.057

LOADINGS ON THE FINAL CONFIGURATION IN 5 DIMENSIONS
FOR THE SEMANTIC FEATURES TEST - GRADE VIII INDIVIDUAL #1

	1	2	3	4	5
1	0.413	-0.767	-0.275	-0.292	-0.415
2	-0.610	-0.165	-0.320	-0.659	-0.227
3	-0.265	-0.103	0.487	-0.735	0.336
4	-0.450	-0.200	-0.037	0.762	-0.228
5	0.097	0.283	-0.722	-0.516	0.394
6	-0.301	-0.205	-0.232	0.029	-0.834
7	-0.832	0.102	-0.100	0.070	0.540
8	0.655	0.045	-0.499	0.246	-0.459
9	0.668	0.648	-0.107	0.143	0.171
10	-0.420	-0.802	0.415	0.249	0.013
11	0.292	0.055	0.438	0.540	-0.566
12	0.156	-0.025	0.773	0.422	0.412
13	-0.021	-0.768	-0.282	-0.238	0.474
14	0.077	0.526	-0.024	-0.538	-0.691
15	0.843	-0.460	0.305	0.158	0.167
16	-0.443	0.708	-0.738	0.209	-0.222
17	0.275	-0.310	0.756	-0.393	-0.474
18	0.180	0.105	-0.304	0.864	0.434
19	0.134	-0.119	-0.021	0.086	0.993
20	-0.178	0.786	0.308	0.352	-0.160
21	-0.064	-0.303	-0.824	0.260	0.062
22	0.659	0.113	0.011	-0.688	0.128
23	-0.091	0.704	0.326	-0.268	0.457
24	-0.772	0.153	0.666	-0.065	-0.305

LOADINGS ON THE FINAL CONFIGURATION IN 5 DIMENSIONS
FOR THE SEMANTIC FEATURES TEST - GRADE VIII INDIVIDUAL #3

	1	2	3	4	5
1	0.181	-0.650	-0.081	0.591	-0.468
2	-0.701	0.427	-0.036	-0.542	-0.070
3	0.023	-0.539	0.275	-0.515	-0.623
4	-0.677	-0.018	-0.519	0.331	0.327
5	0.215	-0.121	-0.884	-0.417	0.286
6	-0.044	-0.195	-0.598	-0.400	-0.564
7	-0.476	-0.446	-0.224	-0.482	0.549
8	0.535	0.347	-0.008	-0.238	0.723
9	0.506	0.231	-0.344	0.339	-0.626
10	-0.705	-0.501	0.499	-0.032	0.123
11	-0.227	0.337	0.404	0.146	-0.754
12	0.374	-0.482	0.516	0.193	0.551
13	0.144	-0.016	0.242	-0.914	0.186
14	-0.671	-0.260	-0.277	0.244	-0.599
15	0.970	0.037	0.100	-0.264	-0.304
16	-0.345	0.728	-0.298	0.599	-0.227
17	0.045	-0.110	0.927	0.538	-0.239
18	0.414	0.156	-0.636	0.497	0.342
19	-0.382	0.341	0.274	0.094	0.823
20	-0.100	-0.329	-0.018	0.823	0.376
21	0.126	0.774	-0.386	-0.408	-0.117
22	0.475	-0.774	-0.177	-0.118	0.181
23	0.340	0.685	0.406	0.379	0.226
24	-0.020	0.378	0.841	-0.443	-0.102

APPENDIX G

THE SEMANTIC FEATURES TEST

TEST KEY

INDIVIDUAL #3

GRADE VIII

NAME KEY - INDIVIDUAL #3 Grade VIII
(Last) (First) (Middle)

AGE (Years) YEAR or GRADE ☐ Male ☐ Female DATE (Day) (Month) (Year)

FACULTY or SCHOOL

I.D. NUMBER

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

1. _____

_____

2. _____

Indicate response by placing a mark between the guidelines as shown in the example. Use HB pencil. Don't make marks longer than guidelines.

Example —

CAUTION — AVOID PLACING ANY MARKS AMONG THE BLACK TIMING LINES

1 b	45 a	89 a	133 a
2 b	46 a	90 a	134 b
3 b	47 a	91 b	135 a
4 a	48 b	92 a	136 a
5 a	49 b	93 a	137 b
6 a	50 a	94 a	138 a
7 b	51 a	95 b	139 a
8 a	52 a	96 b	140 a
9 b	53 a	97 b	141 a
10 a	54 b	98 a	142 b
11 b	55 b	99 b	143 b
12 b	56 a	100 a	144 b
13 a	57 b	101 b	145 b
14 b	58 b	102 b	146 b
15 b	59 a	103 a	147 b
16 a	60 a	104 b	148 a
17 b	61 b	105 a	149 a
18 a	62 b	106 a	150 a
19 b	63 a	107 a	151 a
20 a	64 a	108 a	152 a
21 b	65 a	109 a	153 b
22 b	66 a	110 a	154 a
23 a	67 a	111 a	155 b
24 a	68 a	112 a	156 b
25 b	69 b	113 a	157 b
26 a	70 a	114 b	158 a
27 b	71 a	115 a	159 b
28 a	72 b	116 a	160 a
29 b	73 b	117 b	161 a
30 b	74 b	118 a	162 a
31 a	75 a	119 b	163 a
32 a	76 a	120 b	164 a
33 b	77 b	121 b	165 b
34 a	78 b	122 a	166 a
35 b	79 b	123 a	167 b
36 b	80 a	124 b	168 b
37 b	81 b	125 b	169 a
38 b	82 a	126 a	170 a
39 a	83 b	127 a	171 a
40 a	84 b	128 a	172 a
41 b	85 a	129 b	173 b
42 a	86 a	130 b	174 a
43 b	87 a	131 a	175 b
44 a	88 b	132 a	176 b

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TM507

NAME KEY - INDIVIDUAL #3 Grade VIII
(Last, First, Middle)

FACULTY OR SCHOOL

AGE (Years) YEAR OR GRADE ☐ Male ☐ Female DATE (Day, Month, Year)

I. D. NUMBER

0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9
0	1	2	3	4	5	6	7	8	9

1. _____

_____

2. _____

Indicate response by placing a mark between the guidelines as shown in the example. Use HB pencil. Don't make marks longer than guidelines.

Example

CAUTION — AVOID PLACING ANY MARKS AMONG THE BLACK TIMING LINES

177 a b
178 a b
179 a b
180 a b
181 a b
182 a b
183 a b
184 a b
185 a b
186 a b
187 a b
188 a b
189 a b
190 a b
191 a b
192 a b
193 a b
194 a b
195 a b
196 a b
197 a b
198 a b
199 a b
200 a b
201 a b
202 a b
203 a b
204 a b
205 a b
206 a b
207 a b
208 a b
209 a b
210 a b
211 a b
212 a b
213 a b
214 a b
215 a b
216 a b
217 a b
218 a b
219 a b
220 a b
221 a b
222 a b
223 a b
224 a b
225 a b
226 a b
227 a b
228 a b
229 a b
230 a b
231 a b
232 a b
233 a b
234 a b
235 a b
236 a b
237 a b
238 a b
239 a b
240 a b
241 a b
242 a b
243 a b
244 a b
245 a b
246 a b
247 a b
248 a b
249 a b
250 a b
251 a b
252 a b
253 a b
254 a b
255 a b
256 a b
257 a b
258 a b
259 a b
260 a b
261 a b
262 a b
263 a b
264 a b
265 a b
266 a b
267 a b
268 a b
269 a b
270 a b
271 a b
272 a b
273 a b
274 a b
275 a b
276 a b
277 a b
278 a b
279 a b
280 a b
281 a b
282 a b
283 a b
284 a b
285 a b
286 a b
287 a b
288 a b
289 a b
290 a b
291 a b
292 a b
293 a b
294 a b
295 a b
296 a b
297 a b
298 a b
299 a b
300 a b

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