74-6994

ZAHLER, O.S.B., Paul James, 1935-
A MEASUREMENT OF MEANING FOR NORMAL AND SUBNORMAL INDIVIDUALS.

The University of Oklahoma, Ph.D., 1973
Education, special

THE UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

A MEASUREMENT OF MEANING
FOR
NORMAL AND SUBNORMAL INDIVIDUALS

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

BY

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Norman, Oklahoma

1973

A MEASUREMENT OF MEANING

FOR

NORMAL AND SUBNORMAL INDIVIDUALS

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ACKNOWLEDGMENTS

I wish to express grateful appreciation to Dr. P. T. Teska, Chairman of the Doctoral Committee, for his guidance, encouragement, and patience through the period of study. I owe many thanks to the statistician of my dissertation, Dr. Omer J. Rupiper, for his advice and assistance. I wish also to extend my appreciation to the other members of my committee, Dr. Mary Clare Petty and Dr. Gene Pingleton.

CHAPTER I

INTRODUCTION AND THE PROBLEM

Introduction

Theories of Meaning

From a historical point of view fairly elaborate and rigorous theories of meaning have emerged. These theories are the mentalistic view, the theory of substitution, the theory of disposition, and the representational theory of mediation.

(a) An "idea" is the essence of meaning: At the core of all mentalistic views is that an "idea" is the essence of meaning. An "idea" as a sign of an object outside of itself gives rise to a mental element associated with that object. It is precisely this element which links or relates the sign and object.

(b) Conditioning an organism evokes meaning: The substitution views, developed by behaviorists such as Watson, apply the Pavlovian principle of "conditioning" to explain and to describe how meaning takes place. Signs of objects receive their meaning by being "conditioned" to the same responses. According to the substitution theory, whenever something which is not the object evokes in an

<u>organism the same reactions evoked by the object, it is a sign of that object</u>. (Osgood, 1952)

(c) <u>Disposing behavior to interpret or give meaning</u>: In the tradition of Pierce and other American pragmatists a sign of an object produces a "disposition" or a "set" of behavior which gives meaning to the object itself. The essence of meaning in this theory, therefore, is that a disposition as a patterned process of behavior "takes account of" or interprets the objects signified.

(d) <u>Total behavior and a kind of self-stimulation elicits meaning</u>: Osgood (Osgood, 1952) contends that meaning "certainly refers to some implicit process or states." Osgood and his co-authors (Osgood, 1952) further describe meaning within the general framework of a learning theory and in the context of current research:

> The meaning of a sign was identified as a representational mediation process--representational by virtue of comprising some portion of the total behavior elicited by the significant and mediating because this process, as a kind of self-stimulation, serves to elicit overt behaviors, both linguistic and non-linguistic, that are appropriate to the things signified.

In an attempt to coordinate the measure of meaning with the theory of meaning, Osgood and his colleagues (Carroll, 1959) define meaning as "a distinctive mediational process or state which occurs in the organism whenever a sign is received (decoded) or produced (encoded)." Hence, the process of mediation is identified with an internal and a "representational" reaction of mediation which, on the one hand, links sign with object and, on the other hand, represents particular stimulus-objects and not to the others. For example, "the meaning of the sign HOUSE is identified with whatever representational process occurs in behavior when an individual has been conditioned to the word HOUSE in contiguity with stimulus patterns which can be characterized as houses." (Carroll, 1959)

Meaning for Osgood and his associates, therefore, is partial identity of the mediation process required to link sign with object. The mediation process represents, or even more, becomes identified with the "dispositions" of the sign and the behavior elicited by the object.

Current Techniques to Measure Meaning

According to Osgood even though theorists do not identify meaning with representational processes of mediation, it is convenient to conceive current techniques to measure meaning as inplicit response processes which produce self-stimulations. Osgood (Osgood, 1952) maintains that the "meager evidence available does not refute this view." With this assumption the various existing techniques for the measurement of meaning can be categorized according to physiological methods, learning methods, perception methods, association methods, and scaling methods.

Physiological methods: Pioneers who investigated organic correlates of meaning developed three different physiological methods to measure meaning.

(a) Measuring sensations: The Wurlzberg School (Osgood, 1952) reported "vague muscular and organic sensations as being present during thought." However, it is argued by Osgood (Osgood, 1952) that this method did not discriminate whether or not "these sensations constitute thoughts and meanings themselves or whether they were merely a background of bodily tones."

(b) Measuring organic reactions: Another pioneer investigation into the organic correlates of meaning was that by Razran (Razran, 1935-1936), who experimentally demonstrated "a relation between amount of salivation and degree of meaningfulness of signs to a sophisticated subject as a possible aspect of meaning." (Osgood, 1952)

(c) Measuring skin responses for emotional effects: A galvanic skin response (GSR) was developed by Jones and Wechsler (Jones and Wechsler, 1928) as being a "good indicator of the emotional effects of stimulus words" and by Mason (Mason, 1941) "for possibly discriminating accompanying changes in meaning related to certainty in meaning, discovery of meaning, and loss of meaning." (Osgood, 1952)

Learning methods: Although learning studies employed meaningful material, Osgood (Osgood, 1952) reports that "rarely was meaning itself the experimental variable." Techniques used in this area have generally centered on the effect of a treatment on learning rather than upon meaning itself or upon the use of learning as an index of meaning. Methods of learning as related to the measurement of meaning come under three main classifications: semantic generalization, transfer of learning, and interference of learning.

(a) Measuring semantic generalizations: Significant data on semantic generalization were obtained by Russian investigators, who set up conditioned reactions, such as salivation and pupillary reflex, to visual and auditory stimuli in order to test word-responses. For example, Kotliarevsky (Kotliarevsky, 1936) conditioned subjects to the sound of a bell and tested their response to the word "bell" to demonstrate the generalization of meaning from the object of the sound of a bell to the word "bell" as a sign. Just as Kotliarevsky and others (Osgood, 1952) showed a generalization of meaning from an object to a sign, Razran and others (Osgood, 1952) demonstrated the essential role of meaningful mediation when a response is conditioned to one sign (e.g., the word TREE) yielding generalization to other signs (e.g., BUSH or the picture of a tree or bush).

(b) Measuring transfer of learning: Experiments contributed by Cofer and Foley (Osgood, 1952) in their various studies of semantic generalization also fit the standard transfer in learning design. Their general procedure was based on comparing the recall of homonym and synonym lists of words to a test list. However, as Osgood (Osgood, 1952) points out, a flaw in Cofer and Foley's design allowed the subject to "catch on" and then "proceed to manufacture the test list rather than recall it." This flaw in design was corrected, however, by Melton and Irwin (Melton and Irwin, 1940) by giving different groups of subjects "varying degrees of learning on the interpolated material" and by comparing "only similar and opposed meaningful responses." (Osgood, 1952)

(c) <u>Measuring interference of learning</u>: Related to the technique of measuring meaning with the method of transfer in learning are experiments on interference in verbal learning by Osgood (Osgood, 1948; 1946). Osgood's (Osgood, 1952) findings point to the general conclusion "that signs which develop a certain meaning through direct training will readily elicit similar meanings but resist being associated with opposed meanings." An example of what is implied by this conclusion is given by Stagner and Osgood (Stagner and Osgood, 1946):

> If the sign RUSSIAN means bad to the conservative college student he easily accepts substitution of <u>dirty</u>, <u>unfair</u>, and <u>cruel</u>, but is is difficult for him to think of Russians as <u>clean</u>, <u>fair</u>, and <u>kind</u>.

<u>Perception methods</u>: Osgood (Osgood, 1952) observes that there are few experiments in which meaning has been introduced as a variable in perceptual methods of

measurement employed by psychologists. However, Brunswick (Brunswick, 1933) and Thouless (Thouless, 1931) posit a relation between perceptual and meaningful phenomena that is borne out by the mere fact of the confusion psychologists display in using these terms.

Some of the more significant methods of perception utilized by researchers whose results were interpreted by psychologists in a variety of ways are the following techniques:

(a) <u>Measuring ability to perceive and solve problems</u>: In one of Maier's (Maier, 1945) techniques the subject is required to change through use the handle of an ordinary lab clamp as something to tighten (original use) to something to hand one's hat on (use which would solve the problem). In order to solve the problem Kohler (Kohler, 1925) and Wertheimer (Wertheimer, 1945) maintain that the handle must be "perceived differently" or the "field restructured perceptually," whereas Duncker (Duncker, 1945) suggests that in virtue of the fact the handle was given "a new functional value," it must "acquire a new meaning or significance as a stimulus." (Osgood, 1952)

(b) <u>Measuring perceptual memory for form</u>: One example of the vast number of studies conducted on memory for forms is an experiment by Carmichael, Hogan, and Walter (Carmichael, Hogan, and Walter, 1932) in which the subject is asked to recall different meaningful words in association with some abstract forms. Koffka (Koffka, 1935) holds that recollection by the subject demonstrates "perceptual dynamics," whereas Bartlett (Bartlett, 1932) states that recall by the subject demonstrates "semantic dynamics."

(c) Measuring perception of sizes: Extremely relevant to the problem of measuring meaning is Brunner and Postman's (Brunner and Postman, 1948) experiment which compares the apparent size of a dollar sign (positive symbol), swastika (negative symbol), and an abstract geometrical design (neutral control). In both the case of the dollar sign and the swastika sign, significant over-estimation was made by the subjects. The investigators report two dynamic processes in operation: (1) "perceptual enhancement due to the positive value of the dollar sign;" (2) "perceptual accentuation of apparent size due to the swastika's alerting the organism to danger or threat." (Osgood, 1952)

(d) Measuring behavioral determinants of perception: By using scores on the Allport-Vernon test to define personal values, Postman, Brunner, and McGinnies (Postman, Brunner, and McGinnies, 1948) investigated behavioral or attitudinal determinants of perception. The results of their study were consistent with the general thesis that personal values of behavior or attitudes have a significant influence on perception.

(e) Measuring perceptual defenses: McGinnies (McGinnies, 1949) pursued this line of research further by introducing yet another issue: the matter of "perceptual defense"--"taboo words were found to require longer exposures for recognition and the pre-recognition presentations were accompanied by significantly stronger emotional reactions." (Osgood, 1952) However, Howes and Soloman (Howes and Solomon, 1950) raise the question to what extent the subjects were inhibited in reporting their meaning or perception of taboo words. May it be that psychologists will be forced to accept some conception of "unconscious" and "conscious" levels of perception and meaning?

(f) Measuring language behavior with an inblock technique: Skinner (Skinner, 1936) devised a sort of verbal inblock technique called a "verbal summator" for studying language behavior which involves the perception of some meaningful forms from samples of meaningless speech sounds. Skinner's verbal summator gets at the comparative strength of verbal habits by evoking "latent verbal responses through summation with imitative responses to skeletal sample of speech." (Osgood, 1952)

Associational Methods: Although analysts agree that word associations are semantically determined, they do differ in the underlying technique used to arrive at the meaning of words by association.

(a) Measuring by means of free association: Freud developed a so-called free association technique in which the patient allows one idea lead to another in a semantically determined rather than a random fashion.

(b) Measuring by means of formal association: Jung used a more formal association approach than Freud to get at the meaning of words by utilizing an established list of words to evoke responses.

(c) Measuring word associations by means of the process of mediation: Karwoski and Berthold (Karwoski and Berthold, 1945), adhering to the premise that the gross majority of word associations are semantically determined, subscribe to the mediation process which is set in motion by the verbal stimulus as a sign. They content that "nearly all responses can be categorized as either some form of similarity or contrast." (Osgood, 1952) Thus, for example, similarity can be recognized by being "either similar in meaning (NEEDLE-pin), which would include hierarchical relations (NEEDLE-thread)." (Osgood, 1952) Contrast response in word associations are "often the direct opposite (LIGHT-dark; MAN-woman)." (Osgood, 1952) It is interesting to note that Osgood (Osgood, 1952) holds "that contrast (or contiguous) responses in word associations are not semantically determined at all, but rather reflect overlearning of verbal skill sequences, akin to FOOT-ball, APPLE-cart, and WASTE-basket."

Woodworth (Woodworth, 1938) supports the position that "the tendency to free associate opposties increases with age, children readily giving similar and contextual responses by rarely opposites." (Osgood, 1952) Karwoski and Schachter (Karwoski and Schachter, 1948) add the fact "that opposites are given with significantly shorter reaction times than similars." (Osgood, 1952)

(d) Measuring by means of color association: An interesting color association method, differentiating responses to sign and object levels, has been developed by Dorcus (Dorcus, 1932) who "compared associations to color words (signs) and actual bits of colored paper (objects)." (Osgood, 1952) He found that "coordinate and contrast responses were most common to color signs (WHITE-black; RED-blue), and the names of contextually related objects were most commonly given to color objects (BLUE PAPER-ribbons; RED PAPER-fingernails)." (Osgood, 1952)

(e) Measuring by means of contextual association: Osgood (Osgood, 1952) considers it as a matter of common observation that both the internal context of man's moods, emotions, and motives, as well as his external situational context, have effect on meaning and influence the character of verbalization. For instance, Bousfield and Barry (Bousfield and Barry, 1937) in a joint study and Bousfield (Bousfield, 1950) by himself found "that subjects' rated moods (on a scale from 'feeling well as possible' to 'feeling as badly as possible') correlated with their rates of production of pleasant vs. unpleasant associates." (Osgood, 1952) However, Osgood (Osgood, 1952) points out that "no research seems to have been done upon the effect of the external, situational context upon meaning," which includes the facial expressions and gestures of speakers, the objects present, the activities underway, slips of the tongue and so on.

Scaling Methods: According to Osgood there has been practically no attempt by psychologists to measure meaning by scaling methods. Osgood (Osgood, 1952) states that "the few timid steps that have been taken in this direction involved drastic limitations on the scope of measurement, being aimed at scaling one or two isolated dimensions of meaning rather than meaning in general."

(a) Scaling with nonsense syllables: Researchers in human learning such as Glaze (Glaze, 1928), Hull (Hull, 1933), and Witmer (Witmer, 1935) attempted to scale meaning by the method of using nonsense syllables as stimuli for word associations.

(b) Numerical scaling with pairs of adjectives: Haagen (Haagen, 1949), in an attempt to provide learning experiments with standardized materials, scaled pairs of common adjectives by having college undergraduates evaluate these words on defined scales of synonymity which was judged on a seven point scale, vividness which was judged also on a seven point scale, familiarity which was judged on a five point scale, and <u>association value</u> judged on a seven point scale. However, Osgood (Osgood, 1952) observes that since synonymity and associative value were always judgments relative to some particular standard word, "they do not offer anything in the way of a measure of meaning." Osgood (Osgood, 1952) also notes that "the familiarity measure has nothing to do with meaning, of course," whereas "the vividness scale, being applied to each word separately rather than comparatively, probably is tapping some generalizable dimension of meaning."

(c) <u>Eleven-point scaling method to measure direction and intensity of meaning</u>: Mosier (Mosier, 1940) selected adjectives from Thorndike's word list and applied an 11-point scale in terms of their favorableness-unfavorableness to the study of meaning. Mosier found that there is a higher degree of agreement on the <u>direction</u> (favorable-unfavorable) of the evaluation than on the <u>intensity</u> (e.g., excellent, good, common, fair, poor) of the evaluation based on the location of the numerical mean value of the scales. With this 11-point scaling method, Mosier demonstrated the possibility of scaling certain aspects of meaning.

<u>Summary of Current Techniques to Measure Meaning</u>: An extensive survey of literature made by Osgood up to 1952 in "The Nature and Measurement of Meaning" fails to uncover any generally accepted, standardized method to measure meaning. At most only related approaches to measure meaning

have been developed: fairly standard methods to measure the comparative strength of verbal habits, such as Thorndike's <u>frequency-of-usage-counts</u> of words in English, <u>semantic habit strength</u> by Skinner, and a <u>sequential association</u> method by Bousfield. However, a technique developed by Osgood as a measure of meaning was made up by a combination of associational and scaling procedures; he called this technique the semantic differential.

The Semantic Differential

Osgood's method of combining associational and scaling procedures to measure meaning had its origin in research on synesthesia, defined in Warren's Dictionary of Psychology (Warren, 1934) as "a phenomenon characterizing the experiences of certain individuals, in which certain sensations of another group and appear regularly whenever a stimulus of the latter occurs." An imaginary type of synesthesia would be for a group of individuals to describe consistently the number "1" to be yellow, "2" to be blue, "3" to be red, and, of course, "8" to be black. Anyone who has played pocket billiards will discover the origin of this system of association between color and numbers.

A report by Karwoski and Odbert (Karwoski, Odbert, 1938) which revealed that 13 per cent of Dartmouth College students indulged in associating color with music "as a means of enriching their enjoyment of music," led to the notion of relating synesthesia to thinking and language in general. (Wheeler and Cutsforth, 1922) Students used bright red forms or verbal metaphors like "red-hot," "bright," and "fiery" to describe their experience of fast, exciting music. The relation of this phenomenon was easily translated by investigators to ordinary verbal metaphors, such as, a happy man is said to feel "high" and a sad man feels "low." Karwoski, Odbert, and Osgood (Karwoski, Odbert and Osgood, 1942) describe the cognitive process of metaphor in language as well as in color-music synesthesia as an example of parallel alignment of two or more dimensions of experience that can be defined, measured, and scaled by pairs of polar opposites as a measure of meaning.

Analytical studies on interrelated and shared meaning among color, mood, and musical experiences were made by Odbert, Karwoski, and Eckerson (Odbert, Karwoski and Eckerson, 1942) demonstrating significant relations: that color associations to musical scores followed the moods created. Similar findings have been reported by Ross (Ross, 1938) for relationships between colors used in stage lighting and reported moods produced in the audience. Osgood (Osgood, 1952) also points out that "data are available for the effects of color upon mood in mental institutions and in industrial plants."

In order to get closer to the modes of translation between auditory-mood variables and color-form variables, Karwoski, Osgood, and Odbert (Karwoski, Odbert and Osgood, 1942) had experienced subjects who were attempting to visualize sound to draw with colored pencils a representation of a simple tone which grew louder and then softer. These drawings paralleled with the loud-soft single note, thereby demonstrating equivalent responses to the same auditory stimulus.

A second experiment used subjects inexperienced in visual-auditory synesthesia in order to eliminate the possibility that the first group of subjects exercised a "rare" capacity for visualizing sound. However, as Osgood (Osgood, 1952) points out, "they produced the same types of visual forms and in approximately the same relative frequencies as the experienced visualizers." Osgood (Osgood, 1952) concludes: "It seems clear from these studies that the imagery found in synesthesia is on a continuum with metaphor, and that both represent semantic relations."

In a study on five widely separated primitive cultures Osgood (Osgood, 1952) also discovered that the semantic relations are not dependent upon culture, but rather "they reflect more fundamental determinants common to the human species."

<u>Summary on the Semantic Differential</u>: In summary, then, Osgood's semantic differential is "essentially a combination of controlled association and scaling procedures." (Osgood, Suci, and Tannenbaum, 1957) The

subject is provided "with a concept to be differentiated and a set of bipolar adjectival scales against which to do it, his only task being to indicate, for each item (pairing of each concept with a scale), the direction of the association" and its intensity if a numerical scale is used. (Osgood, Suci and Tannenbaum, 1957) Osgood and his co-authors (Osgood, Suci and Tannenbaum, 1957) give specific guidelines in order to set up a semantic differential for a specific study:

> The crux of the method, of course, lies in selecting a sample of descriptive polar terms. Ideally, the sample should be as representative as possible of all the ways in which meaningful judgments can vary, and yet be small enough in size to be efficient in practice.

In general, the reasoning which led to the semantic differential as a measurement of meaning grew out of the following interpretations of research:

1. Polar adjectives define the extreme end points and, as a result, the direction of meaning.

2. Stimuli from several modalities, visual, auditory, rational, and verbal, have shared significances or meanings.

3. Synesthesia, as a process in which meaning is shared along different dimensions of experience, is related to thinking and language in general.

4. The difference of subjects experienced in the process of synesthesia or shared meaning across two or more

modes of experience from the general population seems to be one of degree rather than kind.

5. The imagery found in synesthesia is ultimately tied up with language metaphor, and both represent semantic relations.

6. The cognitive process of metaphor in language is the parallel alignment of two or more dimensions of experience which are definable by pairs of polar adjectives; this process is translatable into a semantic differential as a measure of meaning.

7. The semantic differential as a measure of meaning across modes of experience is not entirely dependent on culture but reflects fundamental determinants in the human species.

In conclusion, insofar as Osgood and his colleagues note that meaning is a cognitive state identified with "a representational mediation process," meaning is essentially a problem of the cognitive process of relationship and patterning.

Pilot Study

In a pilot study one of Osgood's semantic differentials was used to measure the meaning of words between elementary individuals in regular classes and elementary individuals in so-called educable special education classes. Visual material was used as stimuli to rate the meaning of concepts in order to eliminate as a significant factor the subject's ability to read. One of the visual rating scales was "colorful-colorless." The question arose whether or not color might be a significant factor in rating the meaning of words.

The Problem

Statement of the Problem

The problem was to determine whether or not the meaning of words in the language and thought of normal and subnormal individuals differ with respect to their perceptual knowledge, understanding, interpretation, and synthesis of picture stimuli based upon Osgood's visual-verbal semantic differential. The technique used was to give the subject a word and two pictures which were opposed in content; his task was to choose which picture best represented the meaning of the word.

Theory and General Hypotheses

In cross-cultural use the meaning of concepts as represented by Osgood's technique has been shown to differ from culture to culture and from individual to individual. The question arose whether the meaning of words as represented by Osgood's technique would yield differences in the meaning of concepts between normal and subnormal individuals.

The general hypotheses of this investigation were the following:

1. There is no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with achromatic visual-verbal "scales" between normal and subnormal individuals.

2. There is no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with achromatic visual-verbal "scales" between males (normal and subnormal) and females (normal and subnormal).

3. There is no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with chromatic visual-verbal "scales" between males (normal and subnormal) and females (normal and subnormal).

4. There is no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with chromatic visual-verbal "scales" between normal and subnormal individuals.

5. There is no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with achromatic and chromatic visual-verbal "scales" among normals.

6. There is no statistically significant difference in the meaning of words as measured by Osgood's differentia-

tion technique with achromatic and chromatic visual-verbal "scales" among subnormals.

Limitations of the Study

This study was made with two groups of subjects, each representing a different intellectual base. Each group was randomly selected from middle socio-economic class. The first group was composed of thirty (30) normal males and females, equally divided by sex; the approximate age ranged between seven and ten years. The second group was composed of thirty (30) randomly selected educable males and females, again equally divided by sex; the approximate age was between ten and thirteen years.

The IQ range of the normals was approximately between 90 and 110 (115); and the IQ range of the educables was approximately between 50 and 70 (75).

CHAPTER II

RESEARCH METHOD

Subjects

There were two groups of subjects, a group of normals, 15 male and 15 female between 7 and 10 years old, and a group of subnormals, 15 male and 15 female educables between 10 and 13 years old. Both groups were from suburban schools in middle socio-economic districts. To reduce variability in the normal group the extremely bright children and the slow learner were excluded, the criterion being deviations of approximately 10 points from the norm of Binet IQ test scores. To reduce variability in the subnormal group, the slow learner and the extremely dull children were excluded, the criterion being a range of 20 (25) points between and between 50 and 70 (75), again according to Binet IQ scores.

Measuring Technique

In practical application, the semantic data generated by Osgood's semantic differential with visual "scales" was arrived at by having individuals rate concepts (m) with binary pictorial alternatives (k), each having polar or opposite meaning. The visual "scales" in both achromatic form (presented in Appendix A, Figure Ia) and in chromatic form (presented in Appendix B, Figure Ib) used in this study were: colorless-colorful (k_{1a} and k_{1b}), dark-light (k_{2a} and k_{2b}), large-small (k_{3a} and k_{3b}), thick-thin (k_{4a} and k_{4b}), dull-sharp (k_{5a} and k_{5b}), and up-down (k_{6a} and k_{6b}).

The verbal concepts (presented in both Appendix A and Appendix B, Figure II) that were rated by the polar pictorial "scales" were the following nouns and adjectives: game (m_1), woman (m_2), fish (m_3), tree (m_4), doctor (m_5), man (m_6), strong (m_7), bad (m_8), quiet (m_{10}), weak (m_{11}), and noisy (m_{12}).

In choosing the visual "scales," consideration was given to their relevancy to the concepts being tested as determined by previous research: Osgood's (Osgood, 1959) "Cross-Cultural Generality of Visual-Verbal Synesthetic Tendencies" and Di Vesta's (Di Vesta, 1966) "Semantic Structures of Children." Consideration also was given to any possible effect color (Obonai, 1956; Ogiso and Inui, 1961; Oyama, Tanka and Chiba, 1962; Oyama, Tanaka and Haga, 1963) may have had in the judgment of the visual "scale," colorless-colorful (k_{1a}), by administering the set of visual "scales" in both achromatic (presented in Appendix A, Figure Ia) and chromatic (presented in Appendix B, Figure Ib) form.

Design

A 6 (scale) X 12 (concept) X 30 (subject) cubes of data were generated for both the normal and subnormal groups by presenting the material used in achromatic and in chromatic form. Since we were interested in systems of meaning relative to groups with different intellectual bases, these cubes of data were summed up and calculated over the 30 subjects for each concept-scale judgment. This task thus involved 60 subjects with each subject being presented 12 concepts judged against 6 scales which were administered first in achromatic form and then in chromatic form.

Procedure

The subjects were tested one at a time, first against the achromatic set of visual "scales" (Appendix A). Each subject was told that he was going to play a word-game in which he would be rating a set of words with pictorial alternatives according to what the words mean to him. The general procedure was to name one of the concepts to be judged and then run through the series of cards, having the subject point to or otherwise indicate which of the two visual alternatives on each card seemed most appropriate to that concept. After that, the next concept was named and run through in the same fashion.

Each subject was instructed on the semantic differential in this manner:

> We are going to play a word game. This is the way the game is played. I am going to give you a card with a word on it. The first word is GAME. Tell me what the word, GAME, means to you. Does GAME mean to you "same" or "different"? "Same" goes with this picture (the administrator points out the pictorial representation of "same") and "different" goes with this one (again the administrator of the test points out the pictorial representation of "different"). So now, what does the word, GAME, mean to you? "Same" or "different"? You may either point to the picture that you think it means or tell me which one you think it means.

The subject was told to go as fast or as slow as he wished and to ask questions at any time. All the subjects had the concept and the "scales" read aloud as they proceeded. The polarity of the visual "scales" was randomized so that the positive alternative did not always appear on the subject's left and the negative alternative on the subject's right. The order of the visual "scales" was also randomized so that they were different for all concepts in order to eliminate the possibility of halo effect.

Statistic

The frequency with which the subjects in both the normal and subnormal groups choose a particular visual alternative for each verbal concept was counted from the data. To test the significance of difference in the meaning of concepts in achromatic and chromatic form, between normal (n = 30) and subnormal (n = 30) groups, as well as between normal-subnormal males (n = 30) and normal-subnormal females (n = 30), the chi square tests were employed. To test for significant differences generated across the 6 (scale) X 12 (concept) X 30 (subject) cubes of data taken as a whole Wilkinson's (Wilkinson, 1951) Table was quoted.

CHAPTER III

RESULTS

Analysis of the data first consisted in making comparisons between the sexes. By combining the normal male subjects (n=15) with the subnormal male subjects (n=15) and likewise the normal female subjects (n=15) with the subnormal female subjects (n=15), comparisons were made in Table 1 and Table 2 on the meaning of words between males and females by means of achromatic visual-verbal "scales" and chromatic visual-verbal "scales" respectively. The chi square statistic was employed in order to generate 72 scores in each table in the form of a three-dimensional matrix: subjects (n=30) by concepts (m=12) by "scales" (k=6).

In the achromatic concept-"scale" combination of 72 scores contained in Table 1, two statistically significant differences were found between males and females; and in the chromatic concept-"scale" combination of 72 scores contained in Table 2, one statistically significant difference was found between males and females. According to Wilkinson's Table of Probability (Wilkinson, 1951) these respective statistical differences generated between males and females in Tables 1 and 2 could occur by chance alone. Therefore, since no statistically significant difference was found in the comparisons of the sexes for the measurement of meaning, the sex variable was combined in order to increase the size of the sample to make the other comparisons.

Table 1

Chi Square Values of the Differences in the Meaning of Words between Normal and Subnormal Males + (n=30) and Normal and Subnormal Females + (n=30) for each Concept-'Scale' Combination in Achromatic Form.

		Achromatic Visual-Verbal Scales					
		k_1	k_2	k_3	k_4	k_5	k_6
concept		colorless colorful	dark light	large small	thick thin	dull sharp	up down
m_1	Game	04.705*	01.067	00.937	00.069	00.000	00.000
m_2	Woman	08.102*	00.937	01.875	00.000	01.067	00.328
m_3	Fish	03.516	00.645	02.468	01.736	00.602	01.875
m_4	Tree	00.266	00.075	01.666	14.007	00.000	00.104
m_5	Doctor	02.424	00.000	00.000	00.266	00.066	00.000
m_6	Man	00.625	00.000	02.091	00.069	00.269	00.085
m_7	Strong	01.067	03.281	01.232	01.422	00.293	00.282
m_8	Bad	00.274	00.085	00.075	00.610	00.000	00.085
m_9	Good	00.838	00.079	00.071	00.066	00.075	00.085
m_{10}	Quiet	00.000	00.282	00.067	00.000	00.000	01.097
m_{11}	Weak	00.282	02.538	00.645	01.794	00.000	00.000
m_{12}	Noisy	01.666	00.282	00.000	00.071	00.000	00.000

+ For each of the following groups, n=15:normal males, normal females, subnormal males, subnormal females

* Values significant beyond the .05 level.

TABLE 2

Chi Square Values of the Differences in the Meaning of Words between Normal and Subnormal Males+ (n=30) and Normal and Subnormal Females +(n=30) for each concept-'Scale' Combination in Chromatic Form.

		Chromatic Visual-Verbal Scales					
		k_1	k_2	k_3	k_4	k_5	k_6
concept		colorless colorful	dark light	large small	thick thin	dull sharp	up down
m_1	Game	00.328	01.674	00.714	00.274	00.067	00.675
m_2	Woman	00.000	00.079	01.128	03.325	00.066	00.269
m_3	Fish	00.293	02.402	00.000	00.079	00.067	02.538
m_4	Tree	00.075	06.075*	00.144	00.000	00.645	00.522
m_5	Doctor	00.000	00.293	00.079	00.069	00.675	00.093
m_6	Man	01.097	00.269	00.144	00.085	0 .602	01.571
m_7	Strong	01.097	01.736	00.000	00.392	00.085	01.781
m_8	Bad	00.079	00.269	01.666	00.602	00.293	00.000
m_9	Good	00.000	00.071	01.794	03.266	02.130	00.079
m_{10}	Quiet	00.069	00.076	00.066	00.069	01.077	00.000
m_{11}	Weak	00.071	01.128	00.000	00.282	00.274	00.000
m_{12}	Noisy	00.274	01.067	00.079	00.079	00.282	00.000

+ For each of the following groups, n=15:normal males, normal females, subnormal males, subnormal females.

* Values significant beyond the .05 level.

The second step in the analysis of the data consisted in comparisons between achromatic visual-verbal "scales" and chromatic visual-verbal "scales" for normals and subnormals respectively in order to examine statistically the visual performance of each group relative to color. By combining the normal male subjects (n=15) with the normal female subjects (n=15) and likewise the subnormal male subjects (n=15) with the subnormal female subjects (n=15), comparisons were made in Table 3 and in Table 4 on the meaning of words for each concept-"scale" combination in achromatic and in chromatic form among normals (n=30) and subnormals (n=30) respectively. The chi square statistic was employed in order to generate 72 scores in each table according to subjects (n=30) by concepts (m=12) by "scales" (k=6).

In the measurement of meaning among normals for each concept-"scale" combination in achromatic and chromatic form contained in Table 3, five statistically significant differences were found; in the measurement of meaning among subnormals for each concept-"scale" combination in acromatic form contained in Table 4, three statistically significant differences were found. According to Wilkinson's Table of Probability (Wilkinson, 1951) these respective statistical differences in Tables 3 and 4 could occur by chance alone. Therefore, it can be assumed that there is no statistically significant difference between the achromatic and chromatic visual

TABLE 3

Chi Square Values of the Differences in the Meaning of Words Among Normals (n=30) for Each Concept-"Scale" Combination in Achromatic and in Chromatic Form.

Achromatic and Chromatic Visual-Verbal Scales

concept		k_1 colorless colorful	k_2 dark light	k_3 large small	k_4 thick thin	k_5 dull sharp	k_6 up down
m_1	Game	01.666	00.000	00.000	00.071	00.067	00.000
m_2	Woman	01.128	04.565*	01.128	001069	00.000	01.313
m_3	Fish	00.075	01.666	00.308	00.071	00.066	00.675
m_4	Tree	01.794	00.328	00.144	00.000	00.274	00.000
m_5	Doctor	00.000	04.176*	00.000	00.069	00.000	00.144
m_6	Man	00.079	00.602	00.185	00.838	00.625	00.185
m_7	Strong	00.602	00.067	00.000	00.000	00.714	00.093
m_8	Bad	00.328	07.702*	03.888*	01.067	00.085	00.767
m_9	Good	00.104	00.675	00.714	00.000	00.000	00.000
m_{10}	Quiet	00.000	00.714	01.067	00.066	00.293	00.071
m_{11}	Weak	00.069	02.130	00.282	00.282	00.392	00.067
m_{12}	Noisy	00.282	00.000	00.000	00.104	00.069	04.512*

*Values significant beyond the .05 level.

TABLE 4

Chi Square Values of the Differences in the Meaning of Words Among Subnormals (n=30) for Each Concept-"Scale" Combination in Achromatic and Chromatic Form.

		Achromatic and Chromatic Visual-Verbal Scales					
		k_1	k_2	k_3	k_4	k_5	k_6
concept		colorless colorful	dark light	large small	thick thin	dull sharp	up down
m_1	Game	00.675	00.610	01.313	00.269	00.274	00.079
m_2	Woman	00.602	00.085	00.075	04.688*	00.066	01.077
m_3	Fish	00.000	00.282	01.172	00.675	00.610	00.000
m_4	Tree	00.269	00.282	00.185	01.781	00.085	00.767
m_5	Doctor	00.266	02.604	05.880*	01.067	02.402	01.097
m_6	Man	00.000	00.075	00.000	00.610	00.000	00.282
m_7	Strong	00.067	00.610	02.954	00.293	00.000	06.075*
m_8	Bad	00.610	00.069	00.000	00.000	00.645	00.000
m_9	Good	00.000	00.075	01.077	01.071	01.232	00.274
m_{10}	Quiet	00.071	00.675	00.000	01.128	00.000	00.066
m_{11}	Weak	00.000	01.666	00.602	00.071	00.282	00.675
m_{12}	Noisy	00.066	01.077	00.069	00.602	00.071	02.402

*Values significant beyond the .05 level.

visual performance on the measure of meaning for normals and subnormals respectively.

Since no statistically significant difference was found either among normals or subnormals relative to color, comparisons were made between normals and subnormals on the meaning of words for each concept-'scale' in achromatic form and in chromatic form respectively. In Table 5 the chi square statistic was employed to measure the meaning of words between normal (n=30) and subnormals (n=30) by concepts (m=12) and by "scales" (k=6) in achromatic form. Of these 72 concept-"scale" comparisons in achromatic form, thirteen statistically significant chi square values were found. Statistically significant differences were found between the concept of GAME and the achromatic visual-verbal "scale" of Colorless-Colorful, between the concept of FISH and the achromatic visual-verbal "scale" of Large-Small, between the concept of TREE and the visual-verbal "scale" of Up-Down, between the concept of DOCTOR and the visual-verbal "scale" of Large-Small and Up-Down, between the concept of MAN and the achromatic visual-verbal "scale" of Up-Down, between the concept of STRONG and the achromatic visual-verbal "scale" of Thick-Thin, between the concept of BAD and the visual-verbal "scale" of Dark-Light and Large-Small, between the concept of GOOD and the achromatic visual-verbal "scale" of Large-Small, between the concept of WEAK and the achromatic visual-verbal "scales" of Dark-Light and Dull-Sharp, and

TABLE 5

Chi Square Values of the Differences in the Meaning of Words Between Normals (n=30) and Subnormals (n=30) for Each Concept-"Scale" Combination in Achromatic Form.

	Achromatic Visual-Verbal Scales					
concept	k_1 colorless colorful	k_2 dark light	k_3 large small	k_4 thick thin	k_5 dull sharp	k_6 up down
m_1 Game	04.705*	00.000	00.104	00.069	00.274	00.000
m_2 Woman	00.602	02.604	00.075	02.772	00.000	01.313
m_3 Fish	00.071	00.071	04.388*	00.069	00.066	00.675
m_4 Tree	00.000	01.875	00.185	01.781	00.308	05.105*
m_5 Doctor	00.000	00.000	04.705*	01.067	03.281	07.702*
m_6 Man	01.736	00.293	00.522	01.736	01.077	06.903*
m_7 Strong	00.266	00.066	01.232	05.688*	00.000	02.538
m_8 Bad	00.097	04.176*	06.075*	00.067	00.000	00.767
m_9 Good	00,838	00.079	04.512*	02.402	00.675	02.130
m_{10} Quiet	00.000	00.000	00.067	00.000	01.128	01.097
m_{11} Weak	00.282	10.152*	00.071	00.071	04.388*	01.172
m_{12} Noisy	00.600	00.000	01.172	05.813*	00.282	01.077

*Values significant beyond the .05 level.

between the concept of NOISY and the achromatic visual-verbal "scale" of Thick-Thin. The achromatic visual-verbal "scale" k_3 (Large-Small) produced the greatest number of statistically significant differences which were on the concepts FISH, BAD, and GOOD. However, taken as a whole these 13 out of 72 significantly different chi square values could have occurred by chance alone according to Wilkinson's Table of Probability (1951). Therefore, it can be assumed that there was no statistically significant difference in the meaning of words between normals and subnormals for each concept-"scale" combination in achromatic form.

Further examination of the thirteen statistically significant differences produced by the visual-verbal "scales" in achromatic form in the measurement of meaning between normals and subnormals was made by going back to the original proportions of normals and subnormals choosing each of the visual-verbal alternative for each concept. By inspection of Appendix C it was found: (1) that the achromatic visual-verbal stimuli Colorless-Colorful applied to the word GAME produced a proportion of 1/29 for normals and 8/22 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (2) that the achromatic visual-verbal stimuli Dark-Light applied to the word BAD produced a proportion of 26/4 for normals and 18/12 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (3) that the achromatic visual-verbal stimuli Dark-Light also applied to the work WEAK produced a proportion of 5/25 for normals and 18/12 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (4) that the achromatic visual-verbal stimuli Large-Small applied to the word FISH produced a proportion of 8/22 for normals and 17/13 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (5) that the achromatic visual-verbal stimuli Large-Small applied to the word DOCTOR produced a proportion of 22/8 for normals and 29/1 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (6) that the achromatic visual-verbal stimuli Large-Small applied to the word BAD produced a proportion of 5/25 for normals and 15/15 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (7) that the achromatic visual-verbal stimuli Large-Small applied to the word GOOD produced a proportion of 23/7 for normals and 14/16 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (8) that the achromatic visual-verbal stimuli Thick-Thin applied to the word STRONG produced a proportion of 27/3 for normals and 18/12 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (9) that the achromatic visual-verbal stimuli Thick-Thin applied to the word NOISY produced a proportion of 24/6 for normals and 14/16 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (10) that the achromatic visual-verbal stimuli Dull-Sharp applied to the word WEAK produced a proportion of 22/8 for normals and 13/17 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (11) that the achromatic visual-verbal stimuli Up-Down applied to the word TREE produced a proportion of 28/2 for normals and 20.10 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, (12) that the achromatic visual-verbal stimuli Up-Down applied to the word DOCTOR produced a proportion of 26/4 for normals and 15/15 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals, and (13) that the achromatic visual-verbal stimuli Up-Down applied to the word MAN produced a proportion of 27/3 for normals and 17/13 for subnormals which generated a statistically significant difference in the measurement of meaning between normals and subnormals.

In Table 6 the chi square statistic was employed to measure the meaning of words between normals (n=30) and subnormals (n=30) by concepts (m=12) and by "scales" (k=6) in chromatic form. Of these 72 concept-"scale" comparisons, three statistically significant chi square values were found. According to Wilkinson's Table of Probability (Wilkinson, 1951) these statistically significant differences could occur by chance alone. Therefore, it can be assumed that Table 6 taken as a whole has yielded no statistically significant differences in the meaning of words between normals and subnormals for each concept-"scale" combination in chromatic form. As a result neither the concept-"scale" combination in achromatic nor chromatic form yielded statistically significant difference in the meaning of words between normals and subnormals.

TABLE 6

Chi Square Values of the Differences in the Meaning of Words Between Normals (n=30) and Subnormals (n=30) for Each Concept-"Scale" Combination in Chromatic Forms.

		Chromatic Visual Verbal Scales					
concept		k_1 colorless colorful	k_2 dark light	k_3 large small	k_4 thick thin	k_5 dull sharp	k_6 up down
m_1	Game	02.954	01.674	00.714	01.097	00.067	00.075
m_2	Woman	01.128	00.714	01.128	00.610	00.066	01.077
m_3	Fish	00.293	01.067	06.734*	00.079	00.610	00.000
m_4	Tree	00.675	00.075	00.144	00.000	01.974	00.522
m_5	Doctor	00.000	00.293	00.079	00.069	00.075	02.329
m_6	Man	02.468	01.077	00.144	02.130	03.281	03.535
m_7	Strong	00.000	00.069	00.000	01.571	00.085	00.000
m_8	Bad	01.073	00.269	00.000	00.602	01.172	00.000
m_9	Good	00.000	00.071	00.071	03.266	00.085	06.428*
m_{10}	Quiet	00.625	00.000	01.666	01.736	00.269	00.269
m_{11}	Weak	00.071	00.000	00.266	00.282	13.440*	00.000
m_{12}	Noisy	01.097	00.266	00.714	01.984	00.000	06.857*

*Values significant beyond the .05 level.

CHAPTER IV

CONCLUSIONS AND OBSERVATIONS

The following conclusions can be made about the sample of normal and subnormal individuals used in this investigation to measure meaning:

1. There was no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with achromatic visual-verbal "scales" between normal and subnormal individuals. However, individually significant chi square values that occurred included the achromatic visual-verbal stimuli Colorless-Colorful as it was applied to Game; the achromatic visual-verbal stimuli Dark-Light as it was applied to BAD and WEAK; the achromatic visual-verbal stimuli Large-Small as it was applied to FISH, DOCTOR, BAD, and GOOD; the achromatic visual-verbal stimuli Thick-Thin as it was applied to STRONG and NOISY; the achromatic visual-verbal stimuli Up-Down as it was applied to TREE, DOCTOR, and MAN.

2. There was no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with chromatic visual-verbal "scales" between normal and subnormal individuals.

3. There was no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with achromatic visual-verbal "scales" between males (normal and subnormal) and females (norman and subnormal).

4. There was no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with chromatic visual-verbal "scales" between males (normal and subnormal) and females (normal and subnormal).

5. There was no significant difference in the meaning of words as measured by Osgood's differentiation technique with achromatic and chromatic visual-verbal "scales" among normals.

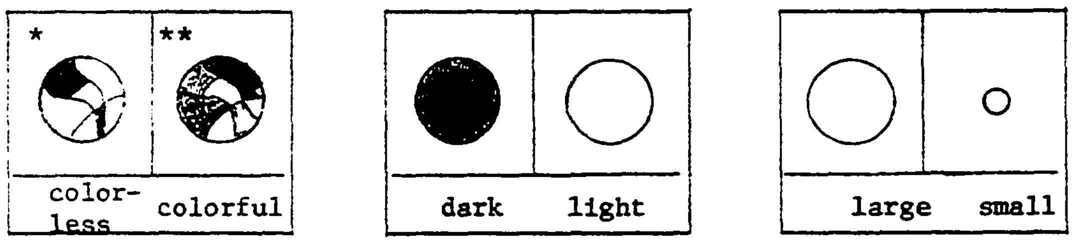
6. There was no statistically significant difference in the meaning of words as measured by Osgood's differentiation technique with achromatic and chromatic visual-verbal "scales" among subnormals.

Since there was no statistically significant difference by sex or by the achromatic and chromatic forms of measurement for meaning, implications for further research would be to increase the number of items and to increase the sample to a larger sample which might yield differences between normals and subnormals which would occur other than by chance.

Appendix A

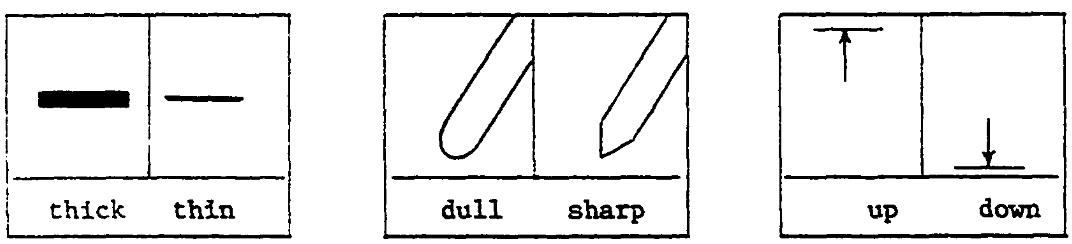
VISUAL-VERBAL SEMANTIC DIFFERENTIAL

Figure Ia:Achromatic Visual "Scales"



k_{1a} k_{2a} k_{3a}

* black & white
**multicolored



k_{4a} k_{5a} k_{6a}

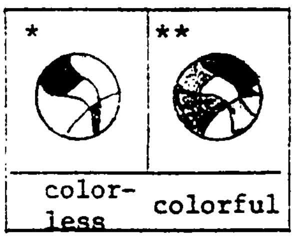
Figure II:Verbal Concepts

NOUNS	ADJECTIVES
m_1 game	m_7 strong
m_2 woman	m_8 bad
m_3 fish	m_9 good
m_4 tree	m_{10} quiet
m_5 doctor	m_{11} weak
m_6 man	m_{12} noisy

Appendix B

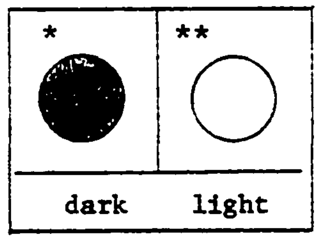
VISUAL-VERBAL SEMANTIC DIFFERENTIAL

Figure Ib:Chromatic Visual "Scales"



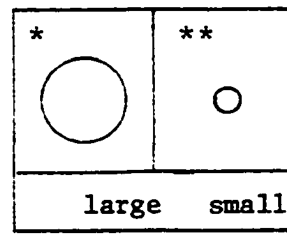
k_{1b}

* black & white
**multicolored



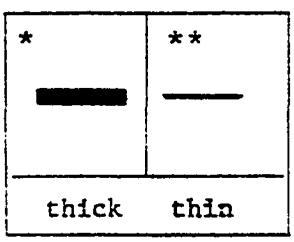
k_{2b}

*pink
**yellow

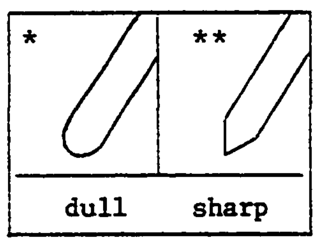


k_{3b}

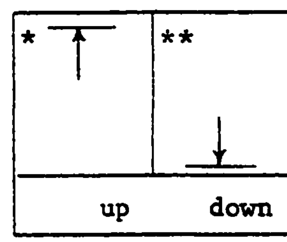
*orange
**yellow



*green **yellow
k_{4b}



*yellow **green
k_{5b}



*purple **blue
k_{6b}

Figure II:Verbal Concepts

NOUNS	ADJECTIVES
m_1 game	m_7 strong
m_2 woman	m_8 bad
m_3 fish	m_9 good
m_4 tree	m_{10} quiet
m_5 doctor	m_{11} weak
m_6 man	m_{12} noisy

Appendix C

Proportions (n=30) of Normals (N) and Subnormals (S) Choosing Each of the Visual-Verbal Alternatives for Each Concept in Achromatic Form.

			Achromatic Visual-Verbal Scales											
			k_1		k_2		k_3		k_4		k_5		k_6	
		concept	colorless	colorful	dark	light	large	small	thick	thin	dull	sharp	up	down
m_1	Game	N	1	29	14	16	24	6	18	12	19	16	21	9
		S	8	22	15	15	24	6	18	12	11	19	22	8
m_2	Woman	N	14	16	3	27	21	9	13	17	14	16	24	6
		S	18	12	9	21	19	11	6	24	15	15	19	11
m_3	Fish	N	11	19	18	12	8	22	18	12	17	13	8	22
		S	11	19	20	10	17	13	18	12	15	15	12	18
m_4	Tree	N	14	16	23	7	27	3	27	3	19	11	28	2
		S	15	15	17	13	27	3	22	8	22	8	20	10
m_5	Doctor	N	16	14	4	26	22	8	17	13	10	20	26	4
		S	17	13	3	27	29	1	12	18	18	12	15	15
m_6	Man	N	9	21	12	18	27	3	21	9	14	16	27	3
		S	15	15	9	21	24	6	15	15	19	11	17	13
m_7	Strong	N	16	14	17	13	23	7	27	3	11	19	22	8
		S	13	17	15	15	18	12	18	12	10	20	15	15
m_8	Bad	N	20	10	26	4	5	25	13	17	22	8	6	24
		S	15	15	18	12	15	15	13	17	21	9	10	20
m_9	Good	N	5	25	8	22	23	7	18	12	8	22	25	5
		S	9	21	10	20	14	16	11	19	12	18	19	11
m_{10}	Quiet	N	13	17	11	19	13	17	15	15	21	9	20	10
		S	12	18	12	18	13	17	14	16	16	14	15	15
m_{11}	Weak	N	17	13	5	25	10	20	10	20	22	8	13	17
		S	20	10	18	12	12	18	12	18	13	17	8	22
m_{12}	Noisy	N	13	17	12	18	22	8	24	6	13	17	14	16
		S	17	13	11	19	17	13	14	16	10	20	19	11

BIBLIOGRAPHY

Bartlett, F. C. Remembering. Cambridge, England: Cambridge University Press, 1932.

Bousfield, W. A. "An empirical study of the production of affectively toned items." J. gen. Psychol., 1944, 30, 205-215.

Bousfield, W. A. "The relationship between mood and the production of affectively toned associates." J. gen. Psychol., 1950, 42, 67-85.

Bousfield, W. A., and Barry, H., Jr. "Quantitative correlates of euphoria." J. exp. Psychol., 1937, 21, 218-222.

Brunner, J. S., and Postman, L. "Symbolic value as an organizing factor in perception." J. soc. Psychol., 1948, 27, 203-208.

Brunswick, E. "Die Zuganglechkeit von Gegenstanden fur die Wahrnehmung." Arch. gen. Psychol., 1933, 88, 377-418.

Carmichael, L.; Hogen, H. P.; and Walter, A. A. "An experimental study of the effect of language on the reproduction of visual perceived form." J. exp. Psychol., 1932, 15, 73-86.

Carroll, John B. "Review of the measurement of meaning." Language, 1959, 35, 58-77.

Di Vesta, Francis J. "A developmental study of the semantic structures of children." J. of verbal Learning and verbal Behavior, 1966, 5, 244-259.

Dorcus, R. M. "Habitual work associations to colors as a possible factor in advertising." J. appl. Psychol., 1932, 16, 277-287.

Duncker, K. "On problem solving." (Trans. by L. S. Lees from 1935 original.) Psychol. Monogr., 1945, 58, No. 5 (Whole No. 270).

Foley, J. P., Jr., and Cofer, C. N. "Mediated generalization and the interpretation of verbal behavior: II. Experimental study of certain homophone and synonym gradients." J. exp. Psychol., 1943, 32, 169-175.

Foley, J. P., and MacMillion, A. L. "Mediated generalization and the interpretation of verbal behavior: V. Free association as related to differences in professional training." J. exp. Psychol., 1943, 33, 299-310.

Glaze, J. A. "The association value of non-sense syllables." J. genet. Psychol., 1928, 35, 255-269.

Haagen, C. H. "Synonymity, vividness, familiarity, and association value ratings of 400 pairs of common adjectives." J. Psychol., 1949, 27, 453-463.

Howes, D. H., and Solomon, R. L. "A note on McGinnies' 'emotionality and perceptual defense.'" Psychol. Rev., 1950, 57, 229-234.

Hull, C. L. "The meaningfulness of 320 selected non-sense syllables." Amer. J. Psychol., 1933, 45, 730-734.

Jones, H. E., and Wechsler, D. "Galvanometric technique in studies of association." Amer. J. Psychol., 1928, 40, 607-612.

Karwoski, T. F., and Berthold, F., Jr. "Psychological studies in semantics: II. Reliability of free associations tests." J. soc. Psychol., 1945, 22, 87-102.

Karwoski, T. F., and Odbert, H. S. "Color-music." Psychol. Monogr., 1938, 50, No. 2 (Whole No. 22).

Karwoski, T. F.; Odbert, H. S.; and Osgood, C. E. "Studies in synesthetic thinking: II. The roles of form in visual responses to music." J. gen. Psychol., 1942, 26, 199-222.

Karwoski, T. F., and Schacter, J. "Psychological studies in semantics: III. Reaction times for similarity and differences." J. soc. Psychol., 1948, 28, 103-120.

Koffka, K. Principles of gestalt psychology. New York: Harcourt Brace, 1935.

Kohler, W. The mentality of apes. (Trans. by E. Winter.) New York: Harcourt Brace, 1925.

Kotliarevsky, L. I. "Cardiovascular conditioned reflexes to direct and to verbal stimuli." (Trans. from Russian title.), 1936. Psychol. Abstracts, 1939, 13, No. 4046.

McGinnies, E. "Emotionality and perceptual defense." Psychol. Rev., 1949, 56, 244-251.

Maier, N. R. F. "Reasoning in human: III. The mechanisms of equivalent stimuli and of reasoning." J. exp. Psychol., 1945, 35, 349-360.

Mason, M. "Changes in the galvanic skin response accompanying reports of changes in meaning during oral repetition." J. gen. Psychol., 1941, 25, 353-401.

Melton, A. W., and Irwin, J. McQ. "The influence of degree of interpolated learning on retractive inhibition and the overt transfer of specific response." Amer. J. Psychol., 1940, 53, 173-203.

Mosier, C. E. "A psychometric study of meaning." J. soc. Psychol., 1940, 53, 173-203.

Obonai, T., and Matsouka, T. "Color-symbolism personality test." J. gen. Psychol., 1956, 55, 229-239.

Odbert, H. S.; Karwoski, T. F.; and Eckerson, A. B. "Studies in synesthetic thinking: I. Musical and verbal associations of color and mood." J. gen. Psychol., 1942, 26, 153-173.

Ogiso, S., and Inui, M. "Measurement of the effect of colors in architecture by the semantic differential." Nihon Kenchikugakkai Ronbunshu, 1961, 67, 105-113 (in Japanese).

Osgood, C. E. "An investigation into the causes of retroactive interference." J. exp. Psychol., 1948, 38, 132-154.

Osgood, C. E. "Meaningful similarity and interference in learning." J. exp. Psychol., 1946, 36, 277-301.

Osgood, C. E. "The nature and measurement of meaning." Psychological Bulletin, 1952, 49, 197-237.

Osgood, C. E. "The cross-cultural generality of visual-verbal synesthetic tendencies." Behavioral Science, 1959, 5, 146-169.

Osgood, C. E.; Suci, G., Jr.; and Tannenbaum, P. H. The Measurement of Meaning. Urbana: University of Illinois Press, 1957.

Oyama, T.; Tanaka, Y.; and Chiba, Y. "Affective dimensions of colors: A cross-cultural study." Jap. psychol. Res., 1962, 4, 78-91.

Oyama, T.; Tanaka, Y.; and Haga, J. "Color-affection and color-symbolism in Japanese and American students." Jap. J. Psychol., 1963. In press (in Japanese with English summary).

Postman, L.; Bruner, J. S.; and McGinnies, E. "Personal values as selective factors in perception." J. abnorm. soc. Psychol., 1948, 43, 142-154.

Razran, G. H. S. "A quantitative study of meaning by a conditioned salivary technique (semantic conditionary)." Science, 1939, 90,89-90.

Razran, G. H. S. "Salivating and thinking in different languages." J. Psychol., 1935-1936, 1, 145-151.

Ross, R. T. "Studies in the psychology of the theater." Psychol. Res., 1938, 2, 127-190.

Skinner, B. F. "The verbal summator and a method for the study of latent speech." J. Psychol., 1936, 2, 71-107.

Stagner, R., and Osgood, C. E. "Impact of war on a nationalistic frame of reference: I. Changes in general approval and qualitative patterning of certain stereotypes." J. soc. Psychol., 1946, 24, 187-315.

Thouless, R. H. "Phenomenal regression to the real object: II." Brit. J. Psychol., 1931, 22, 1-30.

Warren, H. C. (Ed.) Dictionary of Psychology. New York: Houghton Mifflin, 1934.

Wertheimer, M. Productive Thinking. New York: Harper, 1945.

Wheeler, R. H., and Cutsforth, T. D. "Synesthesia and meaning." Amer. J. Psychol., 1922, 33, 361-384.

Wilkinson, B. "A statistical consideration in psychological research." Psychol. Bull., 1951, 48, 156-158.

Witmer, L. R. "The association value of three-place consonant syllables." J. genet. Psychol., 1935, 47, 337-360.

Woodworth, R. S. Experimental Psychology. New York: Holt, 1938.