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AGE AND SEX DIFFERENCES
IN THE SEMANTIC STRUCTURE OF CHILDREN

by

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Abstract

Age and Sex Differences in the
Semantic Structure of Children

Edna R. Small

This research investigated the age and sex similarities and differences in semantic structure of children. The technique both used and studied was the semantic differential, developed by Osgood and his associates as a quantitative approach to the measurement of meaning. In all their previous factor analytic studies, the first three factors have been essentially the same in content and order of magnitude. These have been an evaluative factor (e.g. "good-bad"), a potency factor (e.g. "strong-weak"), and an activity factor (e.g. "fast-slow").

To investigate the degree to which the same dimensions underlie children's semantic judgments, a sixteen-scale form of the differential was constructed, including three scales representing each of the above factors. Seven other scales of theoretical interest to the investigator were included. Two-hundred and seventy-five third, sixth, and ninth grade boys and girls were asked to rate 24 concepts.

The data for each of the six groups, defined by grade and sex, were treated separately. For each group the means of each item (scale concept pairing) were correlated, and the resulting intercorrelation matrix was factored by Thurstone's centroid method. The five extracted factors were then rotated by the quartimax method.

It was predicted that the total amount of variance accounted for by common factors would increase with age, and that an evaluative factor would be more dominant in the younger groups. These predictions were not supported.

The factors which appeared to be qualitatively similar were then compared quantitatively and interpreted. The first factor, quantitatively similar for all age and sex groups, was an evaluative one, highly loaded on "good-bad", "clean-dirty", "happy-sad", and "important-not important".

The second factor, labelled dynamism, was also quantitatively similar for all age and sex groups. Its highest loadings were on two of the previous potency scales, "strong-weak" and "large-small", and one of the previous activity scales, "fast-slow".

The third factor, pointedness, appeared quite clearly in the three girls groups and the sixth grade boys. The two scales with the highest loadings on this factor are "hot-cold", and "sharp-flat", previous activity scales. The absence of "fast-slow" from the cluster led to the choice of the term "pointedness". These pointedness scales merged with the dynamism factor for the third grade boys and defined two separate factors for the ninth grade boys.

The modified reality factor had its highest loadings on "real-make believe" and "true-pretend" in all groups. The subsidiary scales associated with it differed between sex groups. These included negative evaluation scales for the boys, and so the factor was labelled negative reality. The reality factor in the girls group included subsidiary positive dynamism scales and so was called effective reality. This factor is measurably the same for all of the girls groups, but the indices of similarity between boys groups are below the minimum acceptance level.

The fifth factor, labelled self-related, has the least measured similarity across groups of any of the factors. "My very own" has noticeable loadings on this factor in all groups, though the pattern of other scale loadings varies from group to group.

Typically, 75 per cent of the total variance is accounted for by common factors, with the evaluative factor of twice as much magnitude as the dynamism factor. The first three factors, combined, account for from 75 to 85 per cent of the common variance over all six groups.

While similarity as to overall factor structure across age and sex groups was characteristic of the data, some differences were noted. There were slight, but more consistent, sex than age differences. The similarity of the factors obtained in our children's groups as compared with adult groups suggests that the cultural use of the polar terms of the dominant semantic dimensions is adequately learned by the third grade level.

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CHAPTER I

INTRODUCTION AND BACKGROUND

Introduction

Psychologists have tended to approach children's language and language behavior in one of two extremely different ways: a theoretical approach and a descriptive developmental approach.

The theoretical approach includes formulations as to the development and functions of language as part of a more inclusive personality theory. For example, within psychoanalytic theory, the use and understanding of language is seen as an ego-function, and as an aid to the ego in mediating between impulses and reality. Language is said to help to both codify and control aspects of experience and reality (5). We would also include in this category the classical theoretical and empirical work of Piaget. The Language and Thought of the Child (23), in which he describes the egocentricity of children's thought, was one of the first attempts to study children's language as a means of increasing our understanding of the thought processes of the child.

The descriptive-developmental approach to children's language has been much more popular. Investigations in this category range from studies of the birth cry, through other prelinguistic sounds, to inventories of age and content of first words. Investigations then continue with inventories of the size and growth of vocabulary, the rate and quantity

of word usage, the sequential development of parts of speech and units of speech, as well as the interrelationships between language skills. This work has been well reviewed by McCarthy (11). Its main contribution to the present study has been in providing estimates of the familiarity of words to children.

The absence from the above discussion of studies of the meaning of various concepts to children is striking but not surprising. Osgood (17) has pointed out the scarcity of quantitative approaches to the measurement of meaning of adults. The problems of developing such an approach are great in general; they are potentially more difficult with a population of children.

However, the number of studies which approach the measurement of meaning quantitatively is increasing. Over the last decade, Osgood and his associates have systematically been developing a measurement technique called the semantic differential. Basically, this technique involves asking the subject to differentiate concepts, as to their direction and intensity, on a series of bi-polar, adjectival scales. The research done with this technique to date has been primarily aimed at identifying the dimensions underlying such ratings. Several applied studies have then used a form of the semantic differential, defining meaning operationally as the position of a concept on the defined dimensions.

The semantic differential is both the tool and the subject of the research to be reported. We are particularly interested in the general applicability, or comparability across groups, of this technique. Specifically, we are interested in seeing to what extent the semantic structure is similar across age and sex groups in children. This, as such, is an empirical problem which must be investigated before we can use any modification of this technique in applied studies with children. There has been no such research with children reported to date.

Historical background of the semantic differential

The earliest traceable roots of a semantic differentiation technique are in studies of synesthesia, i.e., the phenomenon in which a sensation of one sense modality occurs regularly with a sensation of a different modality. Odbert, Karwoski, and Ekerson (14) found color-music associations of this kind more frequent than had been previously thought. In a companion study with Osgood (7), these investigations were extended to include the role of form in color-harmony. When reduced to verbal terms, reactions usually took the form of related pairs of opposites. This discovery led to a measurement technique used in another study reported in the same article (7). Ten form polarities ("small-large", "light-dark") were each paired with four music polarities ("loud-soft", "treble-bass") and six mood polarities

("happy-sad", "heavy-light"). College students were asked to indicate which word of the second item pair was more closely related to the first word of the previous pair. A large number of the obtained consistencies were significantly different from chance expectations. For example, 97 per cent of subjects associated "bass" with "large" and "treble" with "small." Everyday metaphors (i.e., feeling "high," "low," "blue") can be seen as examples of the same kind of relationship.

The next developmental stage of the semantic differential was based on the hypothesis that a cultural frame of reference is involved in the parallels noted above. The first of these studies of social judgment by Osgood and Stagner (26) was aimed at analyzing the qualities which make up the general prestige frame of reference. Occupational stereotypes were rated against a series of continua whose ends were defined by psychological opposites (polar terms). Several independent dimensions appeared. These authors then applied the same technique to the analysis of a nationalistic frame of reference (27), now using a seven-step scale. Again the scales fell into highly intercorrelated clusters. An attitudinal or evaluative cluster, made up of scales defined by opposites such as "fair-unfair," "kind-cruel," "honest-dishonest" was the clearest. There were also scales rated independently of this cluster. The authors formulated the proposition that one always judges

an object in terms of some frame of reference, in which the basic continuum appears to be a positive-negative one, and which includes other dimensions which add to a conceptualization of the object.

In the next study of this series, Osgood (15) used a variation of this technique to investigate whether individuals make judgments with greater ease in regard to concepts on which a representative sample of people in their culture are polarized in their thinking. Among other things, he found judgment time for polarized items lower than for other items, even if the subject's ratings were not polarized. Apparently the concepts are ones for which culture-members have already made judgments, even if they disagree with the group.

The final paper in this series reports a study of change of thinking in regard to certain stereotypes as we approached our entrance into World War II (28). Again, the dominant evaluative or approval dimension, as well as other independent gradients, appeared. The concept of n dimensional space as a device for representing a frame of reference was introduced.

Theoretical basis of the semantic differential

Osgood's theoretical approach to meaning is an elaboration of Hullian learning theory. The condition which distinguishes sign behavior is the presence of a representational

mediation process in association with the stimulus. The proposition formally states that "a pattern of stimulation which is not the object is a sign of the object if it evokes in an organism a mediating reaction, this (a) being some fractional part of the total behavior elicited by the object and (b) producing distinctive self-stimulation that mediates responses which would not occur without the previous association of nonobject and object patterns of stimulation" (16, p. 696).[1] Thus, if two signs which are objectively different in their characteristics, and which denote objects objectively different, call forth certain partial reactions which are similar, they are connotatively equivalent in this respect.

The semantic differentiation method has developed along with, rather than out of, the above theoretical formulations. Neither the basic studies concerned with this development nor the fruitful application of the technique have been primarily aimed at establishing the validity of the theory. Nor does the research to be reported here test any hypotheses derived from the above theoretical framework. The measurement of the connotative aspects of meaning has been the central concern, and it is in this sense that

---

[1]While many sources for Osgood's thoeretical position and summaries of research to date are given throughout this text, the reader will find the most systematic and comprehensive coverage in references 17 and 19.

we use the term "meaning." Meaning, as used throughout this paper, can be operationally defined as the profile of a concept on several dimensions. This is discussed more fully below. For introductory purposes we need only point out that we are concerned with the connotative aspects of signs, rather than with the denotative, or pragmatic aspects emphasized in sociological definitions of meaning or with the syntactic aspects emphasized in linguistic definitions.

There have been other approaches to the study of what we may call meaning. These are summarized by Osgood in an article on "The Nature and Measurement of Meaning" (17). His survey of the literature uncovered no accepted, standardized method for measuring meaning. Physiological methods are cumbersome, not sufficiently sensitive, and lack comparability as general measures of meaning. Perceptual methods are seen by Osgood as measures of comparative habit strength rather than meaning.

The semantic differential is a combination of association and scaling methods. The chief drawback of the usual association methods is lack of comparability, while the usual scaling methods have not allowed for multidimensionality. The semantic differential has been designed to overcome both of these disadvantages. It provides scales of known factor composition on which subjects are asked to differentiate concepts. Subjects are presented a sample of bi-polar scales, each of which is a seven point continuum

defined at the extremes by a pair of polar terms, along with concepts to be rated. A subject is asked to indicate both the direction and intensity of his association. If, for example, "war" carried a somewhat bad connotation for him, this would be represented as follows:

WAR

Good '_____'_____'_____'_____'_____'_✓_'____' Bad

One of the major aims in developing the semantic differential was to find a small number of scales which hopefully would be representative of the major ways in which the mediation process can vary. The three hypotheses relating to the logic underlying this aim are as follows:

> 1. The process of description or judgment can be conceived as the allocation of a concept to an experiential continuum definable by a pair of polar terms.
>
> 2. Many different experiential continua, or ways in which meanings can vary, are essentially equivalent and hence may be represented by a single dimension.
>
> 3. A limited number of such continua can be used to define a semantic space within which the meaning of any concept can be specified. (18, p. 5)

In an attempt to discover a limited number of dimensions in which meanings vary and which together would account for a large portion of the total variance involved in judgments, several factor analytic studies were undertaken.

Factor analyses of semantic judgments

In the first factor analytic study, 100 male undergraduates rated twenty diverse concepts on 50 bi-polar, seven-point scales. Scales were selected by a frequency of usage criterion, and almost half of them were evaluative in nature. Osgood and Suci (21) conceptualize the resulting data as a 50 x 20 x 100 cube, each cell of which contains a number from one to seven which indicates the scale position. They summed over both subjects and concepts into a single 50 x 50 matrix of intercorrelations, which was then factored by Thurstone's centroid method. Four orthogonal factors were extracted, three of which had meaningful loadings. They were labelled as evaluative, potency, and activity factors, and together these factors accounted for about 60 per cent of the total variance, with the evaluative factor contributing to 67 per cent of the common variance. Scales such as "good-bad," "beautiful-ugly," "fair-unfair" were highly loaded on this factor. Scales such as "strong-weak," "heavy-light," "large-small" were highly loaded on the potency factor. The scales with the highest loadings on the activity factor were "fast-slow," "active-passive," "hot-cold."

A second factor analysis was undertaken using the same scales but no concepts, in order to circumvent the concept-scale interaction noticed by the authors in the previous study. Each scale was paired with every other

scale and 40 subjects were asked to indicate which of the second pair was closer in meaning to the capitalized word in the first pair. The score used was the percentage of agreement between scales. This percentage matrix was factored by the D method of factoring, described by Osgood and Suci (21). A very similar factor structure appeared, with the first factor clearly an evaluative one, and the second and third what may be called potency and activity factors. Unfortunately, the D method of factoring does not provide an estimate of the per cent of variance accounted for in the second study.

In a mimeographed "Report on the development and application of the semantic differential" (18) Osgood reports a study by Solomon (25), in which trained sonarmen rated sonar signals on an almost completely new set of 50 scales. The same three factors appeared in the same order of magnitude.

Osgood also reports a study by Tucker (34) in which artists and non-artists rated paintings against 40 bi-polar scales. Again, evaluative, potency, and activity factors appeared, although the scale composition of these factors varied somewhat from that found in the previously mentioned studies.

The final study reported to date uses a much more representative series of scales[1] (19). It was undertaken to investigate the 40 to 50 per cent of variance unaccounted for by the three common factors in previous studies. Seventy-six scales were selected from a representative sampling of the adjectives in Roget's Thesaurus[2], omitting some scales which judges had sorted as extremely similar to others. One hundred male undergraduates used 76 scales to rate 20 concepts, five of which were taken from the original factor analytic study. Eight factors were extracted. Upon quartimax rotation, the evaluative, potency, and activity factors were again identifiable, in the same order of magnitude of loadings, though with some new implications from the scale composition. A square root factorization was then done in order to more readily interpret the remaining factors. Factor I is again an evaluative factor, with several modes of evaluation interpretable from the scales which are also loaded on other factors. Factor II is clearly a potency factor. Factor III is now called an "oriented" activity factor. Former activity scales such as "hot-cold," "active-passive" have relatively pure loadings on this factor. The subsidiary loadings of several evaluative

---

[1]The report of this research became available after the inception of this study, and so was not considered in the design. The results, however, are important in any discussion of the dimensionality of the semantic structure.

[2]This study will be referred to as the Thesaurus study throughout the remainder of this report.

scales lead to the term "oriented." The remaining identifiable factors include a stability factor, with "sober-drunk" as the pivotal scale. A fifth factor, centering around "angular-rounded," is tentatively labelled tautness. On the sixth factor, novelty, "new" and "unusual" have the highest loadings. The seventh factor, receptivity, is identified by a larger number of scales with relatively low loadings. The central scale is "savory-tasteless." The only sizeable loading of the eighth factor is on the "aggressive-defensive" scale. Osgood suggests that this aggressiveness factor be considered as a specific source of variance for the time being.

In summary, in all of the factor analyses of semantic judgments reported to date, the first three factors have been essentially the same, both in content and in order of magnitude. The likelihood of additional factors suggested by the specific variance left in the first two studies is supported by the results of the Thesaurus study. Even when additional factors were identified, each accounted for no more than half of the amount of variance which was attributable to the potency and activity factors. Further research is required to indicate whether use of such additional factors will add significantly to the predictive validity of the semantic differential.

CHAPTER II

PROBLEM AND DESIGN

The Problem

To what extent are semantic frames of reference the same in groups of children that differ as to school grade and sex? This is the central problem of the present research. This research had two principal goals: (1) to investigate the chronological development and stability of semantic factors; (2) to investigate the feasibility of using a given modification of the semantic differential measurement technique with children differing in age and sex. A subsidiary aim was to collect data for further analysis should such an application prove feasible.

Hypotheses

The above problem is primarily an empirical one. However, we had some expectations as to the result which may be stated as hypotheses.

A. Age differences

Hypothesis I.: The total amount of variance accounted for by common factors will increase with age.

Less common variance in younger children could result from more specific variance in the use of the scale terms, and/or more intra-group variability of ratings. It could also be a function of lower reliability of ratings of younger children. A repeat-item reliability measure was built

into the test design for use if the results confirmed the above hypothesis.

This hypothesis was derived from several converging lines of thought. The possibility of lower item reliability in the lower grades is a common problem in research involving children's ratings. In a study such as this, it would lead to a lower proportion of common variance.

However, we can expect a lower percentage of total variance from more theoretical positions. Osgood's view of meaning as a mediation process is explicitly a learning theory approach. We would, therefore, expect the use of culturally frequent parallel associations to increase with age, leaving more specific, denotative variance in the younger groups. Werner's (35) descriptions of synaesthetic thinking as a kind of verbal syncretism more characteristic of child than adult thought might be taken to argue against this. He does not, however, imply that the translations from child to child would be similar, and so does not contradict our hypothesis.

The idiosyncratic use of words, which would also lead to increased intra-group variability among younger children is a reasonable expectation from several points of view. Shared frames of reference are acquired through social interaction, and so would be expected to be less well defined in younger children. However, the cultural use of language may be adequately acquired by the age of our

youngest subjects. The work of Piaget (23) leads us to assume that such a difference should distinguish at least our third graders from the older groups. He reported a marked decrease in ego-centric thought at approximately seven and a half years of age, with a then gradual increase in social communication and understanding between children over the next several years.

Also relevant is Schachtel's discussion (24) of the conventionalization of experience (and memory) which takes place as cultural schemata, or frames of reference are imposed upon the vivid, but non-verbalizable experience of the child. Certainly the presentation of predetermined scales on which concepts are to be differentiated is such a cultural imposition; the degree to which these scales are used in consistent patterns may reflect the degree to which the culturally dominant frames of reference have been adopted.

> Hypothesis II.: The evaluative factor (i.e., "good-bad") will account for a greater proportion of the common variance at the younger age levels.

This hypothesis again was derived from several independent lines of thought. While there is not a direct connection, our thinking was influenced by psychoanalytic theory, which considers the child's earliest categorizations of objects to be in terms of pleasure vs. pain, satisfaction

vs.lack of satisfaction, goodness vs. badness. We find this same dichotomy posited in neo-Freudian theory, as in Sullivan's description of the child's conception of the "good mother" and the "bad mother," the "good me" and the "bad me" (30).

We can more easily extrapolate from the observations of Piaget to the above hypothesis. He describes children's thought, as inferred from a study of their language, as decreasing in ego-centricity with age, through the younger ages in our study. In addition, he links "value" thought with ego-centric thought. We would expect the evaluative dimension, a primarily "good-bad" reaction, to be more dominant in the younger children.

We come to the same hypothesis from a slightly different aspect of Piaget's theory, also found in Werner (35). They both postulate the development of cognitive structure to be a process of increasing differentiation. Thus we would expect additional factors or more clearly defined second and third factors to appear in our older groups, with the evaluative dimension accounting for a smaller proportion of the common variance.

We find that Osgood has made the same hypothesis, perhaps from similar lines of reasoning; perhaps the dominance of the evaluative factor in research to date suggested its developmental priority. We quote below the relevant paragraph from his new book in greater detail than is necessary for this particular point because of the relevance

it has for this study in general.

> One of the most basic ways in which individuals or groups could differ cognitively would be in terms of the underlying dimensions of judgment they use in differentiating among concepts. They could differ 1) in the number of factors required to account for their judgments, 2) in the relative weights given to the same set of factors (e.g., one group giving much more weight to the evaluative factor), or 3) in the nature of the factors used....It was shown by Kumata and Schramm, for example, that even groups as divergent in language and culture as Americans, Japanese, or Koreans seemed to use the same major factors in closely the same relative weights. It is still possible, however, that subgroups selected within a single culture on some basis might differ in these respects. It seems likely, for example, that in the development of meaning in children, differentiations will appear earliest in the dominant evaluative factor, gradually progressing into other, more diversified dimensions... (19).

A subsidiary hypothesis was made which content-wise belongs more properly with the future analyses of the data. It was included in order to check on the applicability of some of the statistical techniques applied to the data:

Hypothesis III.: The younger the children the more dichotomous (extreme) will be the ratings.

This hypothesis was based on the supposition that younger children are more likely to think (and respond) in simple categorical fashion, (i.e., large or small) rather than in terms of scale gradations.

E. Sex differences.

The data will be analyzed separately for boys and girls.

Hypothesis IV.: To the extent that the hypothesized age differences are found, girls will show earlier maturation in these respects.

This hypothesis is based on the consistent evidence in studies of language development of a slight difference in favor of girls as compared with boys (11).

Previous comparisons of semantic factor structures

There have been several studies which included the comparison of factor structures obtained from semantic differential ratings.

The study by Osgood and Suci (21), mentioned earlier, compared results obtained by ratings with and without concepts. They found essentially the same factors both times.

In a cross-cultural study of meaning, Kumata and Schramm (9) obtained separate factor structures for groups of Americans, Koreans, and Japanese. The indices of agreement between groups for the first two factors, the evaluative and the dynamism factor[1], indicated essential similarity.

Bopp (2) compared the factorial structure obtained from semantic ratings of normal and schizophrenic subjects. She found essentially the same factor structure in both groups.

In order to apply the semantic differential to many of the problems for which it is potentially useful, it is

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[1]The dynamism factor represents a combination of activity and potency scales, and is discussed more fully later.

necessary to investigate the degree to which the scales on a given scale battery represent similar dimensions for different groups. The last two studies mentioned offer encouraging evidence for the comparability of results across groups. Our study has been designed to extend this research to additional subgroups defined by school grade and sex.

The form of the semantic differential used

Scales.- The scales were selected with an overall criterion that they be familiar to most third grade children. This was checked by reference to the Thorndike-Lorge word count (33), and by a vocabularly pretest administered to a third grade class in a nearby community. Within this limit, scales were selected to represent Osgood's three reappearing factors (the evaluative, activity and potency dimensions) while avoiding words that were nearly synonomous (e.g., "good-bad" and "nice-awful.") Other scales of theoretical interest to the investigator were included. The 16 scales used and their assumed factor indentifications, were the following:

Evaluative	Potency	Activity	Reality-Stability
good-bad	large-small	hot-cold	real-make believe
happy-sad	thick-thin	fast-slow	true-pretend
clean-dirty	strong-weak	sharp-flat	now-past
			always the same-not always the same

Ego-centricity
my very own-everybody's
important-not important
close-far away

The eight new scales were considered on an a priori basis to represent dimensions of reality and ego-centricity. No hypotheses were made as to these dimensions appearing or changing with age, due to the possibility that these dimensions may be stabilized by age eight or nine, and/or evidence of reactions along such dimensions would not appear in the use of language in such a highly structured situation. They were included primarily for exploratory purposes.

Concepts.-The scales rather than the concepts were of primary interest for the present study. The majority of the concepts were chosen, with future research in mind, representing the areas of self, school and family. Other concepts were added to increase the diversity of the stimuli. The 24 concepts used are listed below in the order in which they were administered to the subjects.

1. Boy	9. Policeman	17. My Father
2. My Mother	10. A Nurse	18. My Mouth
3. Candy	11. Me	19. Dirt
4. My School	12. Fire	20. God
5. Baby	13. Movies	21. My Fist
6. Automobile	14. The Devil	22. My Home
7. Girl	15. Doll	23. My Teacher
8. Money	16. Sled	24. Snakes

Test Form.-The concepts were presented in such a way that a subject rated one concept on 10 scales before

shifting to another concept.[1] All 24 concepts were rated on 10 scales in the first test booklet, and then presented in the same order in a second booklet with the remaining six scales, as well as four repeated scales for purposes of evaluating item reliability. The order of the scales and the positions of the polar terms were varied. There were four master orders each used with six concepts.[2]

Subjects

The groups serving as subjects for this study included 275 third, sixth, and ninth grade children enrolled in the Belleville, Michigan public schools. Parental occupations are chiefly semi-skilled or small, independent farming. Table 1 presents the number of children in each group, as well as the mean age of the portion of that group for whom age data was obtained. An inspection of the scores obtained on school-administered intelligence and aptitude tests indicated that the two sex groups within each grade were essentially similar on obtained scores.

Originally entire classroom groups were tested. Children whom teachers had identified as non-readers were

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[1] Osgood's (19) research on the effect of form, comparing the above type of presentation with one in which both concept and scale are rotated, found no difference in results obtained. The former method is more satisfying to the subjects and so was used here.

[2] The master forms are presented in Appendix A, followed by a list of test booklet page number, concept rated on that page, and scale master-page used.

TABLE 1.-Size and mean age of the six subgroups

Group	Total N	*N* on which mean age is based	Mean age (in years and months)
Third grade boys (3M)	45	44	8-11
Third grade girls (3F)	47	46	8-10
Sixth grade boys (6M)	45	45	12-0[a]
Sixth grade girls (6F)	48	48	12-0[a]
Ninth grade boys (9M)	44	41	14-11
Ninth grade girls (9F)	46	43	14-10

[a]The one oldest S in each of the sixth grade groups was older than the youngest ninth graders in the same sex group. The criteria for eliminating subjects appear below in this section.

excluded, as were those who did not meet the demands of the task in other ways. This included subjects who 1) did not finish, 2) pattern marked, 3) frequently omitted pages or 4) were obviously "horsing-around."

Administration of the semantic differential

As part of the introduction to the research, each group was told that this was research from the University of Michigan, not in any way connected with school; the tests would not be graded, there were no right or wrong answers, and that their teachers would not see their booklets. They were also told that we were interested in comparing all of

the children in one grade with all of another grade, rather than in individual answers.

The rating scale was then explained, using the first (sample) page in their booklets, labelled ICE CREAM. Several scales on this page were explained. It was suggested that the subject first decide which scale term best fit the word on the top of the page (i.e., do you think of ICE CREAM as "large" or "small"?) and then mark the position, indicating, for example, "very large", "medium large," or "a little large." This was demonstrated several times. Subjects were asked to use the neutral position as little as possible. Individual explanations were then given to subjects who were still unclear as to the nature of the task. This was accomplished on the third grade level with the aid of five twelfth grade students who gave individual explanations and assisted in the reading of difficult words. The total testing time varied from 45 to 90 minutes for each of the 11 classrooms.

Current use of the data

The use of the semantic differential generates a large amount of data which can be analyzed in many ways. The analyses to be reported here are restricted to those relevant to a comparison of semantic factor structures. Future analyses of the data will be more concerned with questions of application (the reliability of ratings and their stability over time) and group differences in word meaning (factor profiles of words).

CHAPTER III

METHODS OF ANALYSIS

Throughout the analysis an effort was made to follow the methodology used in previous studies as closely as possible. Separate analyses were made for each of the six groups, defined by age-sex combination. All of the computing through the factor analyses was done on the IBM 650 Magnetic Drum Data Processing Machine of the Statistical Laboratory of the University of Michigan. The raw data was coded into scores from one to seven, then transferred to IBM cards with the scale order constant over concepts.[1]

The data necessary for the factor analyses were the correlations within each group of each scale with every other scale. As the problem ultimately involved group comparisons, the means of each item (scale-concept pairing) were computed for each group.[2] The means were then correlated to yield a

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[1]As the machine analysis could not be run with any blank columns in the data sections of the cards, missing data had to be supplied by the investigator. When a single item had been omitted, the modal response of the given group on that item was used. When several items for a given concept were omitted by a subject, all of the responses of an alternate subject not included in the final sample were used for that concept.

[2]In two of the groups, third grade girls and sixth grade boys, the N on which all of the scale-means for four of the concepts were based was different by one from the usual N. This had been first discovered in a third group, at which time that data was reanalyzed. As the corrected mean values were altered only slightly in the third decimal place, we felt it unnecessary to take additional machine time to correct the figures in the two other groups.

16 x 16 interscale correlation matrix. The coefficients of correlation were product moment coefficients, as this best fits the requirements of factor analysis, and has been the method used in the previous semantic differential studies in which concepts were used. We were concerned, however, that our distributions of use of scale points might be dichotomous, especially in the 3rd grade. Table 2 presents the per cent of polar responses (scores of 1 and 7), intermediary responses (scores of 2, 3, 5, 6) and neutral

TABLE 2.-Scale checking styles: per cent of responses in scale positions

Group	Position		
	Polar	Intermediate	Neutral
3M	69%	30%	1%
3F	65%	32%	2%
6M	56%	38%	5%
6F	58%	37%	5%
9M	53%	42%	5%
9F	57%	39%	4%

responses (scores of 4) for all of the groups. We can compare this with the percentages for the normal adults in Bopp's study (2). She found 36 per cent of these adult responses in the polar extremes, 35 per cent in the intermediate

positions, and 29 per cent in the neutral position. While we find the decrease with age in use of the polar positions as predicted, all of our groups use the intermediate positions at least 30 per cent of the time. The greater proportion of polar responses in the third grade is balanced by an increased use of the neutral position in the older groups. The use of the neutral position still does not approach Bopp's figure, and may be a function of our instructions to use this position only as a last resort and/or the compliance of the subjects.

The 16 x 16 correlation matrix for each group described above was the input for the factor analysis. The program used is one based on Thurstone's centroid method for the extraction of factors.

The technique used to rotate the centroid factors was the quartimax method developed by Neuhaus and Wrigley (13), which has been adapted to electronic computers. This rotation method is a blind procedure which seeks the orthogonal transformations which maximize the squared variance (4th powers) of the factor loadings. In so doing, it increases the size of the larger loadings and the number of near-zero loadings. In this way the solution approaches orthogonal simple structure.

We were then in a position to compare the similarity of the rotated factors across groups. This was done both qualitatively and quantitatively. Qualitatively, an

arbitrary criterion was set for considering a scale highly loaded on a given factor. This was done after inspecting the loadings, and the criterion varies from factor to factor. A loading of .75 or more on Factors I and II, and of .60 or more on Factors III, IV, and V was considered "high."

The index of factorial similarity used to measure the agreement between factors which qualitatively appeared similar is obtained from the formula

$$e_{ij} = \frac{\sum_k f_{ki}\, g_{kj}}{\sqrt{\sum_k f_{ki}^2\, g_{kj}^2}}$$

where f_{ki} and g_{kj} represent the loadings of the kth variable on the ith factor for one group and the jth factor for a second group. The formula was used in the studies by Osgood and Suci (21), Kumata and Schramm (9), and Bopp (2). References to its use may be found in Burt (4) and Barlow and Burt (1).

The formula for estimating the level of e which would indicate a lower level of good fit between the factors being compared was obtained from Bopp (2) and Kumata and Schramm (9). Using this formula

$$e \geq \sqrt{\frac{1}{2}\left(1 + \frac{1}{\sqrt{n}}\right)}$$

where the number of variables is n, our minimum e level for good fit is .79.

CHAPTER IV

RESULTS: AN INTERPRETATION OF FACTORS[1]

This investigation was primarily empirical in nature. In this chapter we shall present the results needed to evaluate the broad hypotheses that guided our thinking, and at the same time discuss the similarities and differences in semantic factors between age and sex groups.

In the centroid analysis, 5 factors were extracted for each of the six groups.[2] We had predicted that the data would show age and sex differences in the total amount of variance accounted for by common factors. Table 3 presents the per cent of total variance accounted for by each of the centroid factors, as well as the total per cent of variance accounted for by common factors, for each of the groups.

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[1]Because of the extensive nature of the intermediate data in this investigation, little seems to be gained by presenting them in the body of this report. The interested reader will find a formal presentation of the intercorrelation matrices and the centroid factor matrices of the six groups in Appendix B. In fact, because of their bulk, and the difficulty in comprehending all of the data at once, it seemed unwise to include even the six rotated factor matrices within the text; these matrices are also presented in Appendix B. In this chapter, the findings relevant to an interpretation and discussion of the rotated factors are presented in a form designed to facilitate such interpretation.

[2]The decision was made to stop at 5 after having extracted 6 in one group and finding that a few of the communalities had gone over 1.00 on the 6th factor.

TABLE 3.-Percentage of total variance accounted for by 5 centroid factors

Group	Factor Number I	II	III	IV	V	Total
3M	.38	.20	.08	.05	.04	.75
3F	.31	.23	.09	.07	.05	.75
6M	.37	.18	.08	.06	.04	.73
6F	.36	.19	.09	.06	.06	.76
9M	.41	.16	.07	.05	.06	.75
9F	.40	.19	.08	.08	.04	.79
Median	.375	.190	.080	.060	.045	.75

Our first hypothesis, i.e., that the total amount of variance accounted for by common factors will increase with age, is clearly not supported by the data.[1]

[1]It is for this reason that we are not reporting the reliability study included in the research design. The hypothesized lower common variance in the younger groups might have resulted from either a more specific denotative use of words or a lack of reliability in their ratings. The obvious comparability in total variance accounted for in all of the groups, and the respectability of these obtained values when compared with other studies, reduces the importance of this aspect of the question of reliability.

Our second hypothesis concerning the relative magnitudes of the evaluative factor is discussed in connection with the treatment of the similarities and differences of groups in the rotated factors. For the sake of clarity, the factors appearing qualitatively alike are discussed together. For each such factor, a table is presented which indicates the scales with the highest factor loadings, the indices of similarity within age and sex groups, and the percentages of both total and common variance accounted for by the factor for each group.

The Evaluative Factor

The first and most pervasive factor in all age and sex groups is clearly an evaluative one. The scales highly loaded on this factor, (Table 4) for all groups are the three evaluative scales from Osgood's first factor analytic study, "good-bad," "happy-sad," and "clean-dirty." The additional scale of "important-not important" also meets the qualitative criteria for considering a scale highly loaded.

In essence, this factor is the same in all groups. All of the e values are well above the .79 criterion level. The main difference between groups is in the loadings of the two reality scales, "real-make believe" and "true - pretend." The evaluative loadings of these scales tend to increase with age. Perhaps this trend reflects the increasing acceptance of a cultural positive evaluation of "truth" and

TABLE 4.-The evaluative factor: salient factor loadings and indices of factor similarity (e)

A. 1. Scales high (loading ≥ .75) in all groups.

Group:	3M	6M	9M	3F	6F	9F
Rotated factor #	I	I	I	I	I	I
Good-bad	.95	.90	.89	.94	.94	.98
Clean-dirty	.92	.83	.82	.94	.92	.96
Happy-sad	.95	.91	.91	.92	.96	.96
Important-not important	.87	.84	.82	.80	.75	.79

2. Scales high in some groups

Close-far away	.85	.83	.92	.67	.86	.91
True-pretend	.55	.77	.87	.35	.35	.68
Real-make believe	.46	.73	.84	.23	.33	.47
Now-past	.73	.72	.70	.79	.60	.54

B. e values (Lower limit of good fit = .79)

	Age comparisons, males			Sex comparisons		
	3M	6M	9M	3F	6F	9F
3M	___	.94	.93	.96		
6M		___	.99		.96	
9M			___			.97
				Age comparisons, females		
3F				___	.98	.95
6F					___	.98
9F						
% of total variance	.35	.36	.39	.30	.31	.36
% of common variance	.46	.50	.52	.40	.41	.46

"reality." It is interesting to note that in Osgood's Thesaurus study (19), the highest loading of the scale "true-false" (.50) is on the evaluative factor, with a subsidiary loading on the stability factor. In our data, contrary to original expectation, the boys in each group have higher loadings on these "reality" scales than the girls. We had predicted that if age differences appeared, girls would show earlier maturation. However, it is possible that the higher loadings of these "reality" scales in the boys groups and at the older age levels may reflect an increasing cultural restriction of the use of fantasy with age, with this pressure felt earlier by the boys. Seen in this sense, this age difference in evaluative loadings would then not be a reflection of language maturity in the more usual sense.

Our second hypothesis was that the evaluative factor would account for a greater proportion of the common variance at the younger age levels. Again, the data clearly do not support this hypothesis. Rather, there is a tendency for this proportion to increase with age, as well as to be slightly higher for boys as compared with girls at each age level.

The relative magnitude of the variance attributable to the evaluative factor leads to some interesting speculations. Our hypothesis of increasing magnitudes with increasing age, formulated independently of Osgood, also appears in his book (See Ch. II, p. 17). Not only is there no decrease with age for our groups, but the magnitudes of the

evaluative factor do not differ markedly from those previously obtained with adults. This would seem to indicate that the dominant cultural use of the evaluative polar terms has been adequately learned by the third grade level. The alternative possibility that a shared frame of reference has not been adopted is contra-indicated by both the similarity of the evaluative loadings and the equivalence of the total percentage of variance accounted for by all of the factors, from group to group. The increase in the magnitude of the evaluative factor with age may be too slight to interpret meaningfully. Nevertheless, this finding suggests an increase with age in the tendency to approach objects with a dominantly evaluative frame of reference.

The question remains as to the relevance of these results to the theoretical formulations cited as support for our original hypothesis. Our results are not necessarily contrary to the position of psycho-analytic theory. While the background of this theory influenced our thinking, it does not hypothesize that this dominant "good-bad" polarity is as strongly operative in middle childhood as in infancy, nor greater in middle childhood than in later years.

The results are perhaps more relevant to the theory of Piaget (9). Although he states that the proportion of ego-centric talk diminishes at around seven to eight years of age, he points out that this is a gradual process and mutual understanding is certainly not complete by that time.

His statement that "judgments of value have far more influence on ego-centric thought than on communicable thought" (23, p. 47) seems to justify our line of reasoning to the hypothesis that the evaluative factor would account for a greater proportion of the common variance in our younger groups.

It would seem then, that our results are negative evidence for Piaget's position. While there is a possibility that the semantic differential is measuring something unrelated to the problems in children's thought which Piaget studied, other evidence supports our conclusion. The majority of studies reviewed by McCarthy (11) failed to replicate the findings of Piaget. In McCarthy's summary, she notes that Bühler (3) has pointed out that the unique environment in which Piaget made his observations may have furthered egocentric behavior. Of particular relevance for us is the control study by Henle and Hubbell (6) in which they found the proportion of ego-centric speech no smaller in adults than had been found in similar studies with children. In addition, they found this category more frequent in adults than social categories.

The Dynamism Factor

The second factor to appear in all groups is again a highly consistent one, with all of the e values above the .79 acceptance level (Table 5). The scales which

TABLE 5.-The dynamism factor: salient factor loadings and indices of factor similarity (e)

A. Scales High (loading ≥ .75) in some or all groups.

Group:	3M	6M	9M	3F	6F	9F
Rotated factor #	II	II	IIa	IIa	IIa	II
Strong-weak	.96	.94	.93	.91	.86	.89
Large-small	.73	.78	.77	.55	.85	.77
Fast-slow	.83	.74	.86	.87	.56	.80

B. *e* values (Lower limit of good fit = .79)

	Age comparisons, males			Sex comparisons		
	3M	6M	9M	3F	6F	9F
3M	___	.92	.93	.92		
6M		___	.98		.94	
9M			___			.99
				Age comparisons, female		
3F				___	.90	.91
6F					___	.96
9F						___
% of total variance	.22	.17	.18	.16	.14	.18
% of common variance	.30	.23	.25	.21	.19	.22

[a]Indicates that factor has been reflected to make the highest loadings positive.

contribute to this factor are two of the original potency scales, "strong-weak" and large-small," and one of the activity scales, "fast-slow."

This merging of the activity and potency scales also occurred in the cross-cultural study reported by Kumata and Schramm (9) from which the label dynamism is borrowed. They suggest that this merging may be a function of the concepts they used. This is an equally good possibility in the present study, where a majority of the concepts are objects (people and institutions) which are actively influential in the child's life. But these concepts are also "good," and none of the 3 dynamism scales have sizeable loadings on the evaluative factor. It seems equally plausible that the merging of the two previous factors in this study is a characteristic of the frames of reference of children, at least. This makes sense intuitively: movement is power, big things (cars, airplanes) go fast. Whether this is actually the case remains an empirical question requiring a study which uses more representative concepts. Some support is found in the representative Thesaurus study where "fast-slow" has its highest loading of .35 on the oriented activity factor, and its only other sizeable loading, .26, on the potency factor.

Let us pause to speculate on a trend in the data thus far reported. While there are no consistent age differences, at each level the dynamism factor accounts for a slightly higher proportion of the common variance for boys as compared

with girls. This may reflect the greater emphasis on size and strength involved in the socialization of boys and in the process of masculine identification, at least in the American culture. According to psychoanalytic theory, these qualities are clearly seen as important in the boy's identification with his father. "I would like to be as big as he is and be allowed and able to do all that he does" (5). Strength and speed are certainly of more concern to boys' peer cultures than to those of girls.

The Thesaurus study also provides some supportive evidence for the cultural view of size and strength as masculine qualities. Here, the scale "masculine-feminine" has its highest loading (.47) on the potency factor.

As before, the second rotated factor is also clearly replicated across our groups.

The first two factors

Taken together, the first two factors account for at least 45 per cent of the total variance and at least 60 per cent of the common variance in all groups. The latter percentage ranges across groups from 60 per cent (6F) to 77 per cent (9M).

These findings strongly support the conclusion that the semantic frames of reference are highly similar across age and sex groups, at least with respect to the two dominant dimensions. The remaining factors are smaller in

magnitude, and less alike across groups. So far we can say that the obtained semantic structures are essentially similar in all six groups. The differences to be found in the remaining factors suggest minor differences on subsidiary dimensions which lead to some interesting speculations.

Pointedness

The third factor which appears in four of our six groups, the three girls groups and the sixth grade boys, has been tentatively labelled "pointedness " (Table 6). All of the e's between these groups meet the minimum level for good fit. While these pointedness scales,"hot-cold" and "sharp-flat", are both allocated to the activity dimension in the original studies, the absence of "fast-slow" from the cluster leads to a different conception of the factor; hence the new label.

The failure of this factor to appear in the third and ninth grade boys is puzzling. For the third grade boys "hot-cold" and "sharp-flat" have their highest loading on the dynamism factor. In addition, these scales have their lowest communalities in the third grade boys group. The obvious explanation would be one of increasing differentiation of the original activity and potency dimensions with age, and with girls being more mature in this respect than boys. But an examination of the loadings of these scales on factor II in all groups does not support this conclusion:

TABLE 6.-The pointedness factor: salient factor loadings and indices of factor similarity (e)

A. Scales high (loading $\geq$ .60) in four groups (3F, 6F, 9F, 6M)

Group:	3F	6F	9F	6M
Rotated factor#	III	IV[a]	III[a]	III[a]
Hot-cold	.84	.83	.72	.68
Sharp-flat	.87	.85	.72	.85

B. e values (Lower limit of good fit = .79)

	Age comparisons, females			Sex comparisons	
	3F	6F	9F	6M	9M[b]
3F	___	.85	.80		
6F		___	.93	.92	
9F			___		.77
				Age comparisons, males	
6M				___	.63
9M					___
% of total variance	.12	.12	.08	.09	.06
% of common variance	.16	.15	.10	.12	.08

[a]Indicates that factor has been reflected to make the highest loadings positive.

[b]Factor V, 9M, has been grouped with the pointedness factor. See table 7 for scale loadings.

there is no consistent age trend. We not only find this merging in the third grade boys, but also more specific variance left in these scales. It would seem indicated to try to replicate this behavior in a similar study, before overemphasizing this aspect of the semantic structure of this group.

We find an equally unusual situation in the factor loadings of "hot" and "sharp" in the ninth grade boys, where they, in effect, tend to define separate factors. One possible explanation is the use of slang and the sensitivity to double entendres on the part of adolescent boys. In these circles, "sharp," and "cool," as opposed to "square" seem to signify a certain kind of approval. A glance at the evaluative loadings of "sharp" across groups supports the formulation of an increasing evaluative connotation to this term. This may be either in the sense mentioned above, or in an intellectual sense. This increased evaluative loading of "sharp" is evident in both ninth grade girls and boys, and supports the above notion of language usage. Finding this possibility supported by the loadings of "sharp" in Factor I, however, leaves us without an explanation of the difference we are now concerned with.

At the same time, it is possible that for ninth grade boys "hot" has taken on a sexual implication. Perhaps it was these kinds of reactions that led to the initial mirth with which some of these classroom groups reacted to the test.

Let us examine factors IV and V of the ninth grade boys more closely, to try to understand the ways in which they differ from the pointedness factor in the other groups. The relevant findings are presented in Table 7.

Factor IV, ninth grade boys.

This factor is primarily defined by its .64 loading on "hot-cold." The six polar terms which are related to "hot" with factor loadings of .20 or more are: "now," "important," "my very own," "thick," "small," and "bad." All but "small" and "thick" have higher factor loadings on the evaluative dimension. This factor may be the analogue to the self-related factor in some of the other groups, and perhaps does reflect a "bad connotation to the "hot" or sexual feelings in this group's current experience. In any case, the combination of "now," "important," and "my very own" with "bad" suggests that this factor, primarily defined by "hot," reflects a conflict area for this group. It would be interesting to introduce other scales which might help to identify this factor more clearly. If, in addition to "hot," one or two other relatively pure measures of this dimension could be found, it might prove useful in study of age and personality differences.

Factor V, ninth grade boys.

In the same way, we can examine the subsidiary scale loadings of factor V. In addition to "sharp," which has a

TABLE 7.-Scale loadings on factors IV and V, ninth grade boys, compared with III, pointedness, ninth grade girls.

A. Scale loadings

Group:	9M	9M	9F
Rotated factor #	IV[a]	V	III[a]
large-small	-.22	-.19	-.03
hot-cold	.64	.22	.72
real-make believe	.01	-.02	-.03
clean-dirty	-.07	.26	.16
my very own-everybody's	.28	.06	-.02
thick-thin	.24	-.24	-.07
now-past	.38	-.19	.02
sharp-flat	.15	.69	.72
good-bad	-.24	-.04	-.10
important-not important	.28	-.09	.12
always the same-not always the same	.09	-.34	-.20
strong-weak	.11	.05	.11
fast-slow	.01	.19	.27
happy-sad	-.18	.22	-.04
true-pretend	-.10	-.06	-.10
close-far away	.17	-.02	-.00
% of total variance	.06	.06	.08
% of common variance	.08	.08	.10

B. e values (Lower limit of good fit = .79)

	9M (IV)	9M (V)
9F (III)	.59	.77

[a]Indicates that factor has been reflected to make the highest loadings positive.

.69 factor loading, there are five scales with loadings higher than .20. The related polar terms include "hot," "clean," "thin," "happy," and "not always the same." The latter scale has its highest loading, .34, on this factor. Taken together, these scales seem to indicate a "valued sharpness," a dimension perhaps peculiar to adolescent boys in our culture. For purposes of grouping, this factor will be classified with the pointedness factor, as it appears closely related to it. The e of .77 with ninth grade girls factor III approaches our .79 acceptance level.

The above discussion of factors IV and V in the ninth grade boys is highly speculative. We should point out that, combined, they account for only 12 per cent of the total variance. Osgood's studies, however, also indicate that the two scales we have been primarily concerned with, "sharp-flat," and "hot-cold," have alternate allegiances, so to speak. In the original study, 65 per cent of the variance of these scales was unaccounted for.[1] What remains could be either specific variance or unreliability. "Sharp" in the Thesaurus study, has been allocated to the tautness dimension, but only with a .18 loading. It has a .29 loading on oriented activity, .17 on potency, and .10 on receptivity. This scale does seem to fluctuate in meaning. It has a communality of only .17, which indicates that a large proportion of its variance is left unaccounted for. In the same study,

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[1]The communality of hot = .22 of sharp, .34.

"hot-cold" is allocated to the oriented activity factor, on which it has a loading of .26. Its next highest loadings are of .13 and .12, on the receptivity and evaluative factors, respectively. Only 12 per cent of its variance has been accounted for by loadings on all factors, while the communality of "hot" for our ninth grade boys is .54. It is interesting to note that this value, at each of our age groups, is lower for the boys than for the girls, and that Osgood's subjects were undergraduate men. Perhaps our findings and speculations reflect a small proportion of what remained as specific variance in Osgood's study.

Modified reality

This factor is one which qualitatively appears similar for all groups (Table 8). When we evaluate the degree of similarity within age and sex groups, we find this factor essentially the same for all of the girls groups but showing age differences for the boys. When we compare boys and girls, the e value meets our minimum good fit level in only the sixth grade. Contributing markedly to the low e values for this factor across several of the groups is the difference in magnitude of the loadings of "real" and "true," which is somewhat determined by the increase of their loadings on factor I with age. Also, the boys consistently had somewhat higher evaluative loadings for these scales than did the girls.

TABLE 8.-The modified reality factor: salient factor loadings and indices of factor similarity (e)

A. 1. Scales high (loading ≥ .60) in most groups.

Group:	3M	6M	9M	3F	6F	9F
Rotated factor#	III[a]	IV[a]	III	V[a]	III[a]	IVa
Real-make believe	.61	.52	.41	.83	.94	.81
True-pretend	.62	.56	.32	.78	.88	.63

2. Additional scales with salient loadings in some groups

Large-small	-.04	-.09	-.20	.10	-.02	-.09
Hot-cold	-.42	-.06	-.04	.04	.05	.02
Clean-dirty	-.24	-.18	-.41	-.02	-.02	-.06
Thick-thin	-.08	.02	-.38	.13	.01	.03
Now-past	.29	.01	.08	.13	.30	.53
Good-bad	-.02	-.18	-.33	.01	-.02	-.10
Important-not important	-.10	.00	.05	.35	.37	.31
Always the same-not always the same	-.02	-.43	-.17	-.20	-.28	-.43
Strong-weak	.09	.07	.06	.28	.39	.25
Fast-slow	.11	.06	.13	.17	.35	.14
Happy-sad	.00	-.19	-.23	-.09	.12	-.04
Close-far away	.30	.18	.14	.34	.29	.23

B. e values (Lower limit of good fit = .79)

	Age comparisons, males			Sex comparisons		
	3M	6M	9M	3F	6F	9F
3M	___	.77	.67	.77		
6M		___	.77		.80	
9M			___			.65
				Age comparisons, females		
3F				___	.97	.90
6F					___	.94
9F						___
% of total variance	.08	.06	.05	.11	.15	.11
% of common variance	.10	.08	.07	.14	.19	.14

[a]Indicates that factor has been reflected to make the highest loadings positive.

We have tentatively labelled this factor "negative" reality for the boys groups, and "effective" reality for the girls groups. We have called this factor modified reality in all groups, to indicate that the other polar terms associated with "real" and "true" are not constant across groups. Here, a sex difference is quite clear. In the boys groups, the associated terms include negative evaluation terms, and so we have modified reality here to become "negative reality." In the girls groups, however, associated terms include positive dynamism ones, and so for girls we have called this "effective reality."

Negative reality, boys.

This factor looks qualitatively the same in all age groups. Inspection of the signs in Table 8 indicate that a difference in magnitude of loadings, rather than direction, contributes to the low e values. The biggest differences, i.e., in "real" and "true," have been discussed above. An examination of the scales with subsidiary loadings will help to further account for the differences. Comparing the third and sixth grade boys, we find "now," "cold," and "dirty" associated with "real" and "true" at the third grade level. Of these, only "dirty" remains in the sixth grade, with "bad," "sad," and "not always the same" added. Negative evaluation here seems to increase with age, through the ninth grade.

The missing negative evaluation loadings appear, for the third grade boys, in the one remaining factor, their factor V. Its highest loadings are on "now," "always the same," "important," "sad," and "dirty," and appears similar to the above factors in the sixth and ninth grades except for the "real" and "true" scales. We can only tentatively consider this a factor: this is the only group in which such a dimension appears, and as it is the final factor, the chances of it being an error of measurement are even greater than for other dimensions which appear in several groups.

Effective reality, girls.

The reality factor is more clearly and consistently defined for all 3 groups of girls. All of the e values are higher than .79 with "real" and "true" go "close", "now", "not always the same," "important", "strong" and "fast." The only consistent age difference is for the last three loadings on the above scales to be higher in the sixth grade than in the other two groups.

Self-related factor

The remaining factor, tentatively labelled self-related, again looks qualitatively similar for all groups when comparing scales with the highest loadings (Table 9). But the e values are relatively low, having the least measured similarity in any of our factors. The pattern of subsidiary loadings varies from group to group, and so provides a

TABLE 9.-The self-related factor: scale loadings and indices of factor similarity

A. Loadings on all scales

Group:	3M	6M	9M	3F	6F	9F
Rotated factor #	IV	V	IVa	IVa	V	V
Large-small	-.48	-.42	-.22	-.62	-.20	-.41
Hot-cold	.14	-.02	.64	-.09	-.24	.12
Real-make believe	.07	.04	.01	.04	.01	-.03
Clean-dirty	-.05	-.22	-.07	.07	.10	-.02
My very own-everybody's	.61	.30	.28	.59	.18	.42
Thick-thin	-.40	-.57	.24	-.24	-.38	-.69
Now-past	.06	-.05	.38	-.31	-.26	.03
Sharp-flat	.31	-.02	.15	.06	.25	-.11
Good-bad	-.26	-.16	-.24	-.00	.06	-.05
Important-not important	.07	.10	.28	-.06	-.17	.12
Always the same-not always the same	.02	-.11	.09	-.15	-.00	.18
Strong-weak	.04	.03	.11	-.18	.20	-.03
Fast-slow	.11	.23	.01	.04	.53	.18
Happy-sad	.01	-.02	-.18	.08	.07	-.05
True-pretend	.11	-.02	-.10	.01	-.01	.01
Close-far away	.29	.25	.17	.29	-.03	.14

B. e values (Lower limit of good fit = .79)

	Age comparisons, males			Sex comparisons		
	3M	6M	9M	3F	6F	9F
3M	____	.82	.42	.77		
6M		____	.14		.56	
9M			____			.22
				Age comparisons, females		
3F				____	.48	.65
6F					____	.48
9F						____
% of total variance	.07	.05	.06	.07	.05	.06
% of common variance	.09	.07	.08	.09	.06	.08

[a]Reflected so that "my very own" is positively loaded.

different context for the interpretation of the central scales. This need not argue against our considering this factor a self-related dimension.

Comparing third and sixth grade boys, this factor does meet the minimum level of good fit. We have assigned factor V in ninth grade boys to this group as the patterns of loadings are qualitatively similar except for the addition of "hot," "now," and "important" in the ninth grade. These added implications which we have previously assumed to have a sexual connotation, account for the greatest differences.

The self-factors for all 3 girl groups are noticeably loaded on "my very own," "small," and "thin." It is interesting to note the increased loadings on "thin" with age, as this is an increasingly important (and generally valued) aspect of girls' body concepts in our culture. The subsidiary loadings vary from age to age and do not make immediate sense. As before, the possibility of error is increased when a factor does not appear measurably the same in more than one group.

Factor magnitudes

It might be useful at this point to compare the per cents of variance accounted for by the rotated factors in all groups. Table 10 presents this data. The variance for similar factors has been listed in a given column, with the rotated factor number included in parenthesis.

Table 10.-Percentages of common variance, rotated factors

	Evaluative	Dynamism	Σ[a]	Pointedness	Σ[a]	Modified Reality	Self-Related	Other
3M	46(I)	30(II)	76		76	10(III)	9(IV)	05(V)
3F	40(I)	21(II)	61	16(III)	77	14(V)	9(IV)	
6M	50(I)	23(II)	73	12(III)	85	8(IV)	7(V)	
6F	41(I)	19(II)	60	15(IV)	75	19(III)	6(V)	
9M	52(I)	25(II)	77	8(V)	85	7(III)	8(IV)	
9F	46(I)	22(II)	68	10(III)	78	14(IV)	8(V)	

[a]Sum of per cent of variance accounted for up to this point.

Factor I, the evaluative factor, is typically of twice the magnitude as Factor II.[1] The first 3 factors (in order of their appearance in table 10) account for from 75 per cent to 85 per cent of the common variance with a given group, leaving from 15 per cent to 25 per cent of the common variance remaining in the two other factors.

[1]This is not true for the third grade boys, where the next factor, pointedness does not appear, but is rather merged with Factor II.

CHAPTER V

DISCUSSION OF RESULTS

Overview of Results

The rotated factor structures for all six of our groups were essentially similar. An overall view of the scale loadings on given factors across groups also indicates essential similarity. The first two factors, the evaluative ("good-bad" and "clean-dirty"), and dynamism ("large-small" and "fast-slow") factors, are clearly replicated in all groups. The third factor, labelled pointedness, (which has its highest loadings on "hot-cold" and "sharp-flat") is clearly replicated in four groups, with the fifth factor in ninth grade boys, highly loaded on "sharp-flat", appearing qualitatively similar. This pointedness dimension does not appear as a separate factor in third grade boys, but seems to be merged into factor two. The fourth factor, modified reality, has the same two scales with highest loadings in all groups, but there are sex differences in the subsidiary scales associated with it. The primary factor allocations of the subsidiary scales suggested that we call this "negative reality" in boys, and "effective reality" in girls. The fifth factor, which seems to be a self-related one, differs across both age and sex groups.

While similarity as to overall factor structure across our groups is more characteristic of the data, some differences have been noted. A comparative summary within age and

sex groups might clarify the essential similarities and differences.

Age Differences

The only consistent age difference found was the tendency for the percentage of variance accounted for by the evaluative factor to increase with age. This apparently was due to increasing loadings on the scales "real-make-believe" and "true-pretend".

Sex Differences

Slight but consistent sex differences appeared more frequently than age differences. Above, we noted that the magnitude of the evaluative factor increased with age. We have found that there is also a tendency for this magnitude to be larger for the boys groups as compared with the girls groups within each age level. There is also a tendency for the second factor, the dynamism factor, to be larger for the boys as compared with the girls.

The most obvious sex difference on the pointedness factor is that it appears for all three of the girls groups, but only for the sixth grade of the boys. The two central scales, "hot-cold" and "sharp-flat" are most highly loaded on the dynamism factor for the third grade boys, and define two separate factors for ninth grade boys.

A small but quite consistent sex difference was found in the subsidiary scale loadings of the modified reality

factor, primarily defined by "real" and "true". These subsidiary scales tend to be negative evaluation ones for the boys groups, and positive dynamism ones for the girls.

The differences on the self-related factor are not consistent over age or sex, and defy interpretation at this point.

In summary, our results primarily indicate an overall similarity in semantic factor structure from group to group. While there are some interesting differences which should be investigated further, the first four factors are essentially the same in all groups. We must, however, point out some of the limitations implicit in our methodology.

It leaves unanswered questions as to the amount of variance necessarily accounted for before considering a factor significant, as well as the significance of factor loadings of various magnitudes in relation to the factor variance. The present factor structure, even though similar across our groups, may be a function of the scales and concepts used, or of our sampling of subjects.

In addition, the interpretation of the factors was based on an orthogonal rotation; an oblique rotation might have led to a somewhat different interpretation of the resultant factor structure.

We can make no claims for the reality of what we have measured; evidence will have to be accumulated by the degree of stability of results in similar studies with other scales

added, as well as from the usefulness of these dimensions in applied research.

Comparison with Previous studies

It may be useful to compare directly our results with the results of two of Osgood's studies, the first factor analytic study and the Thesaurus study. We should keep in mind, however, that the scales we used were much more selective than even those used in the first of the above studies. In fact, we selected nine of our scales on the basis of the results of that original factor analysis of semantic ratings.

In the first study, in which 50 scales and 20 concepts were used, 49 per cent of the total variance was accounted for by common factors. Osgood reports that, in the Thesaurus study, in which 76 more diversified scales, and 20 concepts, were used, the proportion of total variance accounted for was much lower, as a direct result of the method of scale sampling used. In our study, the per cent of total variance accounted for ranges from 73 to 79, larger than in either of the above studies. While this is very likely a function of scale sampling, it does suggest that the assumption of several dimensions which could account for a large proportion of the variance in semantic ratings is as validly made with respect to children as to adults (college students).

In all of the above studies, the evaluative factor was the first and most pervasive one. In the first

factor analytic study, in which scales were selected by a frequency-of-usage criterion, the evaluative factor accounted for 67 per cent of the common variance, while in the more representative Thesaurus study, this factor accounted for only 38 per cent of the common variance. For our groups, the proportion of common variance accounted for by the evaluative factor varies from 40 to 52 per cent. It appears, even given our selected sampling of scales, that this factor is not more dominant in children than in adults.

The activity and potency factors, combined, accounted for 28 per cent of the common variance in the first study, and 27 per cent of the common variance in the Thesaurus study (in which the activity factor appeared to have an "oriented activity" connotation). For our groups, the percentage of common variance accounted for by the dynamism and pointedness factors range from 30[1] to 37 per cent. The differences between our results and those of the previous studies could reasonably be a function of scale-sampling. At the same time, however, we are encouraged that these dimensions, as well as the evaluative one, are as clearly identified in children's ratings as in those made by adults.

In the first study, no other factors were identified, The two additional factors in our group account for from 15 to 25 per cent of the common variance, while in the Thesaurus

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[1]In third grade boys, where only the dynamism factor appears.

study five additional factors account for the remaining 34 per cent of the common variance. While this percentage is partly due to the increased variety of scales used, we can note that a good proportion of the scales loaded on the 5 remaining factors are less familiar to children than those loaded on the first three factors. Perhaps this alone should tell us that the dimensionality of the semantic space increases with age. In any case, it will be useful to see whether the additional scales in both our study and the Thesaurus study markedly increase the predictive validity of the semantic differential.

As to the interpretation of the factors, the first three factors appear to be essentially the same in all three studies. The chief difference between the scale composition of these factors in our study as compared with the first factor analytic study is the allocation of a previous activity scale, "fast-slow" to the potency factor. This led to relabelling the potency factor dynamism, and the activity factor pointedness. The additional factors in both our study and the Thesaurus study have only been roughly mapped out. Further research is needed to clarify them.

As none of the factor analytic studies done with adult subjects have included women, we are unable to compare our results as to sex differences in children with any from studies using adults. However, our finding of slight, but more consistent sex than age differences suggests that sex

differences in semantic factors might be fruitfully investigated on the adult level.

Promising Further Research

The overall finding of an essentially similar factor structure over our age and sex groups leaves unanswered our original questions as to the sequential development of the semantic structure. Our findings suggest that we need to use younger age groups to investigate developmental trends. While such research could not be done with the standard paper and pencil form of the semantic differential, perhaps the essentials could be translated into a physical model to be used with pre-school and lower primary grade children. One might reduce the complexity of the task by using a five or three point scale with variations in intensity defined by blocks increasing in size. Though this would require individual testing, younger children might be able to thus indicate "how much" of a scale a concept had for them. This area of research is an important one if we wish to explore the genetic development of the factors we have found quite well stabilized by the third grade level.

On the other hand, our findings of some age and sex differences in factor composition suggests that extended research using the pencil-and-paper semantic differential with elementary and high school students would add to our understanding of the dimensions underlying semantic judgments.

The results obtained from ratings of a limited set of words and concepts must be considered tentative, even when comparable over several groups. We feel we have roughly mapped out dimensions which further research may fill in more clearly. This should be done in two ways: First, studies investigating the possibility of getting clearer factors by using additional scales which are judged to be equivalent in connotative meaning might confirm or infirm our speculations. Second, studies which used a more representative range of concepts and scales might replicate some of our factors and/or force us to consider them a function of our particular selection of items.

Both of these approaches should use populations of children drawn from a variety of communities and types of schools. Sampling of successive age levels would be desirable to fill in the developmental picture.

Implications for Future Research

It should be emphasized that all of our analyses were based on the mean group ratings of a given concept on each scale. The magnitude of the common factors allows us to consider these mean ratings reliable. Thus, we can conclude that the semantic differential yields reliable ratings for groups of children. The question of the reliability of individual ratings or profiles based on children's ratings, remains a problem for future research.

One of the most exciting implications of the results of our study is the conclusion that we can devise a form of the semantic differential equally applicable to all groups of children, once they have learned to read. This opens up an extensive variety of potential applied researches with children. A brief summary of some of the research reported by Osgood and his associates (18, 19) with adult subjects will illustrate some of the possibilities.

First, however, let us describe the primary approaches to the descriptive handling of semantic differential data. The meaning of a concept, to an individual or a group, may be defined as its profile of scores on several dimensions. If the dimensions used are orthogonal factors, it could be represented as the point, in n-dimensional space, where the projections on each of the factors intersect. Cultural meaning can be operationally defined in the same way, using averaged factor scores to represent the group.

Another possibility is to compare the concepts with regard to similarity or difference in meaning. One could compare two concepts using the same individual or group, the same concept using two individuals or groups, or the same concept and subjects at different times (22).

A third way of using these data is to represent a semantic structure. That can be seen by constructing a matrix giving the distance, in equivalent units, of every concept from every other concept. With three factors, an

actual physical model is possible. Or, as Luria (20) uses, a graphic plotting which represents relations, clustering, and opposition between concepts.

The applications of the semantic differential have been in several different areas of psychology. Tannenbaum (31), for example, has used the evaluative dimension as an attitude measure; Suci (29) reports the increased predictability of voting behavior when a potency scale is combined with the above attitude measure.

The semantic differential has also been applied in research on clinical problems. Bopp (2) investigated association processes in schizophrenia, and found this more determined by semantic similarity than in the control population. Osgood reports doctoral research by Kerrick (8) in which she investigated the effect of intelligence level and anxiety level on attitude change. Osgood (19) reports a study in collaboration with Mowrer in which they compared intra-individual conceptual structures obtained during different phases of psycho-therapy. Moss (12) reports similar research, in which he obtained ratings of significant concepts from a patient in both waking and hypnotic conditions. He found, for example, that the profile distances between ratings of the same object under the two conditions decreased as therapy progressed. He also investigated dream symbols and found that the actual object and the dream representation were rated more similarly under hypnotic than waking conditions.

Lazowick (10) reports a study of identification using a measure of "inferred" identification based on college students' ratings of themselves and their parents, as well as a measure of "direct" identification based on the parents' actual ratings.

Osgood and Luria (20) describe a more typically clinical use of this technique in the analysis of the semantic differential ratings of the three personalities in the case of triple personality described by Thigpen and Cleckley (32). The above does not exhaust the applications to date. A detailed summary of such studies is presented by Osgood (19). We have sought to illustrate the wide range of applications of the semantic differential to date, with the implication that we shall find this technique equally useful in research with children.

In conclusion, we should state explicitly something which has been implicit throughout. The semantic differential is not a standardized test. Rather, it is a "highly generalizable technique of measurement" adaptable and to be adapted to a wide range of problems. Its potential applicability suggests that it is worthy of an increasing number of studies, such as this, which attempt to extend both our understanding of the technique and its usefulness in psychological research.

CHAPTER VI

SUMMARY

This research was designed to investigate empirically the similarities and differences in semantic structure over age and sex groups in children. The technique both used and studied was the semantic differential, developed by Osgood as a quantitative approach to the measurement of meaning. It does this by providing scales of known factor composition on which subjects can differentiate concepts.

The task for the subject is simple. He is presented with a sample of bi-polar scales, each of which is a seven point continuum defined at the extremes by a pair of polar terms, along with concepts to be rated. The subject is asked to indicate both the direction and intensity of his associations.

In an attempt to discover a limited number of dimensions in terms of which meanings vary and which together account for a large portion of the total variance involved in judgments, Osgood and his associates undertook several factor analytic studies. In all of these studies the first three factors have been essentially the same both in content and order of magnitude. They have been labelled an evaluative factor (e.g., "good-bad"), a potency factor (e.g., "strong-weak") and an activity factor (e.g., "fast-slow"). Even when additional factors were identified each accounted for

no more than half of the amount of variance which was attributable to the potency and activity factors.

In order to investigate the degree to which the same dimensions could be said to underlie children's semantic judgments, a form of the differential was constructed which included nine scales used in previous studies, three representing each of the above factors. Seven other scales of theoretical interest to the investigator were included. Two-hundred and seventy-five third, sixth, and ninth grade boys and girls were asked to differentiate 24 concepts on these scales.

In order to compare the semantic structures of age and sex groups, the data for each of the six groups, defined by grade-sex combinations, were treated separately. Within each group the means of each item (scale-concept pairing) were correlated, and the resulting 16 by 16 intercorrelation matrix was factored by Thurstone's centroid method. The five factors which were extracted were then rotated by the quartimax method.

The obtained rotated factor structures were compared both qualitatively and quantitatively. A .79 index of factorial similarity was determined to be the minimum level which indicated good fit between factors.

We had predicted that the total amount of variance accounted for by common factors would increase with age. The data clearly did not support this prediction. We had

also predicted that an evaluative factor would be more dominant in the younger groups. This also was not the case.

The factors which appeared to be qualitatively similar were then compared quantitatively and interpreted. This interpretation was felt to be quite reasonable for the first two factors and more tentative for the three remaining factors. The rotated factors were named as follows, and had the following characteristics:

1. The evaluative factor. The first, most pervasive factor, quantitatively similar between age and sex groups, was an evaluative one, highly loaded on "good-bad", "clean-dirty", "happy-sad", and "important-not important." As all of the previous evaluative scales used appear here we find this factor essentially the same as the first evaluative factor found in the original factor analytic studies.

2. The dynamism factor. This factor appeared second in magnitude in all of our groups, and again the indices of similarity between age and sex groups were quite high. Its highest loadings were on two of the previous potency scales, "strong-weak" and "large-small", and one of the previous activity scales, "fast-slow." This led to naming this factor dynamism rather than potency.

3. The pointedness factor. The third factor, pointedness, appeared quite clearly in four of the six groups: the three girls groups and the sixth grade of the boys. The indices of similarity between these groups met our minimum

acceptance level. The two scales which have the highest loadings on this factor are "hot-cold", and "sharp-flat", previous activity scales. However, the absence of "fast-slow" from the cluster of high scales led to a new interpretation of this factor, embodied in the term "pointedness." The two scales included here in the four above groups merged with the dynamism factor for the third grade boys group and defined two separate factors in the ninth grade boys group. The factor in the latter group defined by "sharp" appeared more similar to the pointedness factor, and so was grouped with it.

4. The modified reality factor. The modified reality factor had its highest loadings on "real-make believe" and "true-pretend" in all groups. However, the subsidiary scales associated with it differed between sex groups. These subsidiary scales included negative evaluation scales for the boys, and so we have modified the tentative factor name to become negative reality. Similarly, the reality factor in the girls group included subsidiary positive dynamism scales and so we have called this factor effective reality. This factor is measurably the same for all of the girls groups, but the indices of similarity between boys groups are below our minimum acceptance level.

5. The self-related factor. The fifth factor, labelled self-related, has the least measured similarity of any of our factors. "My very own" has noticeable loadings

on this factor in all groups, though the pattern of other scale loadings varies from group to group.

Typically, 75 per cent of the total variance is accounted for by common factors for our groups. The evaluative factor is, on the average, of twice as much magnitude as the dynamism factor. The first three factors, combined, account for from 75 to 85 per cent of the common variance over all six groups.

While similarity as to overall factor structure across age and sex groups was characteristic of the data, some differences were noted. The only consistent age difference was the tendency for the per cent of common variance accounted for by the evaluative factor to increase with age. A sex difference also appeared here, in that the magnitude of the evaluative factor was slightly larger for the boys, as compared with the girls, within each grade.

Other sex differences found included a tendency for the magnitude of the dynamism factor to be slightly larger for the boys within each grade. In addition, the pointedness factor appeared in all three of the girls groups, but only in the sixth grade of the boys groups. Another consistent sex difference was found in the subsidiary scale loadings of the modified reality factor.

While the nature of the above factors is to some degree dependent upon our sampling of scales, concepts, and subjects, as well as the method of rotation used, the overall

consistency of our results lead us to conclude that the semantic structure is similar over children's age and sex groups. This general finding suggests that we can devise a form of the semantic differential equally applicable to different groups of children, at least once they have learned to read with some degree of ease. The similarity of the factors obtained in our groups as compared with adult groups suggests that the cultural use of the polar terms of the dominant semantic dimensions is adequately learned by the third grade level.

APPENDIX A

FORM OF THE SEMANTIC DIFFERENTIAL

This appendix presents the four master sets of scales, differing in polar positions and order of presentation of the scales. Each set is composed of two groups of ten scales, on which the same concept was rated twenty-four pages apart. A listing of the test booklet page number, concept rated on that page, and scale master-set used, is also presented.

Master sets of scales

Set I, a	Set I, b
large-small	small-large
hot-cold	hot-cold
real-make believe	good-bad
dirty-clean	important-not important
my very own-everybody's	not always the same-always the same
thin-thick	strong-weak
past-now	slow-fast
flat-sharp	sad-happy
good-bad	true-pretend
not important-important	far away-close

Set II, a

large-small

cold-hot

real-make believe

dirty-clean

not always the same-always the same

weak-strong

fast-slow

happy-sad

pretend-true

close-far away

Set II, b

make believe-real

clean-dirty

everybody's-my very own

thick-thin

now-past

flat-sharp

bad-good

important-not important

always the same-not always the same

weak-strong

Set III, a

my very own-everybody's

thin-thick

now-past

flat-sharp

good-bad

not important-important

not always the same-always the same

strong-weak

fast-slow

sad-happy

Set III, b

small-large

cold-hot

real-make believe

clean-dirty

my very own-everybody's

thick-thin

fast-slow

sad-happy

pretend-true

far away-close

Set IV, a	Set IV, b
small-large	past-now
hot-cold	sharp-flat
make believe-real	bad-good
dirty-clean	not important-important
my very own-everybody's	always the same-not always the same
thick-thin	strong-weak
past-now	slow-fast
flat-sharp	happy-sad
true-pretend	pretend-true
close-far away	close-far away

Composition of the semantic differential used

Concept	Page Number	Scale Set	Page Number	Scale Set
BOY	1	Ia	25	Ib
MY MOTHER	2	IIa	26	IIb
CANDY	3	IIIa	27	IIIb
MY SCHOOL	4	IVa	28	IVb
BABY	5	Ia	29	Ib
AUTOMOBILE	6	IIa	30	IIb
GIRL	7	IIIa	31	IIIb
MONEY	8	IVa	32	IVb

Concept	Page Number	Scale Set	Page Number	Scale Set
POLICEMAN	9	Ia	33	Ib
A NURSE	10	IIa	34	IIb
ME	11	IIIa	35	IIIb
FIRE	12	IVa	36	IVb
MOVIES	13	Ia	37	Ib
THE DEVIL	14	IIa	38	IIb
DOLL	15	IIIa	39	IIIb
SLED	16	IVa	40	IVb
MY FATHER	17	Ia	41	Ib
MY MOUTH	18	IIa	42	IIb
DIRT	19	IIIa	43	IIIb
GOD	20	IVa	44	IVb
MY FIST	21	Ia	45	Ib
MY HOME	22	IIa	46	IIb
MY TEACHER	23	IIIa	47	IIIb
SNAKES	24	IVa	48	IVb

APPENDIX B

INTERMEDIATE DATA AND ROTATED FACTOR MATRICES

This appendix consists of a systematic presentation of the results of the data analyses for each of the six groups: the intercorrelation matrices, the centroid factor matrices, and the rotated factor matrices resulting from quartimax rotation.

While it is extremely difficult to keep in mind the overall pattern of intercorrelations within a group or between the groups, the interested reader may wish to examine specific scale intercorrelations (e.g., tables 11, 12, and 13). To facilitate sex comparisons, each table contains the intercorrelations for both sexes for the grade level; the upper values are for boys, the lower values are for girls. The decision to present age rather than sex groups in the same table was based on the finding of slight, but more consistent, sex than age differences.

The centroid factor matrices are presented in tables 14, 15, and 16. Again, the data for both boys and girls in a given grade are presented in a single table, with the factor loadings on each scale for the girls group presented directly beneath the comparable data for the boys. The interpretation of the factors is based upon the rotated factor structures; the chief interest we have had in the centroid factor data is in the amount of total variance

attributable to sequentially extracted common factors. These findings were also presented, and discussed, in Chapter IV (see page 29). In these more complete tables, the per cent of common variance accounted for by each factor is also indicated. There is a trend for this value for the first centroid factor to be slightly higher for the boys than for the girls within each age level; a similar trend will be noted with respect to increasing values with age.

The complete rotated factor matrices are presented in tables 17, 18, and 19.[1] Again the data for both boys and girls at a given grade are presented in the same table, as described above. The factors are numbered as they were identified in the quartimax rotation; hence like numbered factors are not necessarily psychologically equivalent. In Chapter IV we have attempted to make meaningful group comparisons, abstracting relevant data from these tables.

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[1]When the communalities (h^2) in these tables are not exactly equal to the corresponding ones in tables 14, 15, and 16, the difference (which is in the second decimal place) is a rounding error. The calculations were all based on factor loadings rounded to two decimal places.

TABLE 11.-Intercorrelation matrices, third grade.[a]

Scale[b]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. large	3M--	29	22	-01	-30	61	-03	25	05	20	24	74	58	16	12	-21
	3F--	27	20	-08	-53	46	08	32	-05	14	06	72	59	04	18	-30
2. hot	--	07	25	07	30	-05	42	-02	37	10	41	26	09	-01	-05	
	--	07	-06	-03	25	11	76	-27	25	25	24	12	05	08	-24	
3. real	--	33	21	11	59	07	32	63	16	53	44	44	90	55		
	--	23	07	08	26	16	23	59	-02	60	48	24	97	25		
4. clean	--	26	10	51	-33	89	75	-07	26	20	90	42	65			
	--	37	-22	66	04	94	71	-02	16	06	91	33	62			
5. my very own	--	-16	40	13	21	31	08	19	15	33	28	49				
	--	-17	19	02	33	25	-04	-16	-18	38	10	56				
6. thick	--	-08	32	12	09	14	48	32	07	09	-15					
	--	-19	39	-28	-15	-02	32	12	-17	03	-33					
7. now	--	-42	61	70	19	22	02	59	54	80						
	--	-00	66	72	34	18	-06	64	42	56						
8. sharp	--	-53	-21	05	39	39	-29	01	-39							
	--	-15	26	26	44	40	20	14	-23							
9. good	--	77	06	26	19	89	44	70								
	--	72	-03	17	09	86	33	68								
10. important	--	28	55	43	83	64	72									
	--	16	43	25	78	65	56									
11. always the same	--	44	32	03	07	-07										
	--	22	08	12	08	-27										
12. strong	--	88	47	48	19											
	--	85	33	61	-03											
13. fast	--	42	44	14												
	--	20	46	-07												
14. happy	--	58	74													
	--	36	50													
15. true	--	66														
	--	33														
16. close	--															
	--															

[a]Decimal points are omitted from this and all following tables.

[b]Scales are designated by the positive polar term in this and all following tables.

TABLE 12.-Intercorrelation matrices, sixth grade.

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. large	6M--	24	12	-00	-23	54	14	20	11	14	32	76	55	-04	12	-02
	6F--	32	04	-08	-50	52	10	26	-06	10	08	69	39	-05	06	-16
2. hot		--	-02	-03	01	32	-01	63	-33	14	18	27	09	-20	-14	-13
		--	11	14	-07	28	30	75	-17	38	-21	31	21	00	13	01
3. real			--	44	35	11	60	27	55	81	-26	55	39	52	96	64
			--	33	11	08	43	20	30	64	-35	58	45	44	98	53
4. clean				--	29	13	47	38	83	58	-24	12	10	90	50	57
				--	42	-07	49	37	90	63	-30	22	12	91	34	71
5. my very own					--	-06	31	18	28	35	-14	12	05	31	30	52
					--	-25	18	-03	38	27	-02	-13	-05	39	09	48
6. thick						--	16	32	06	11	18	37	03	-04	09	-07
						--	10	18	-17	-07	03	29	-01	-21	06	-20
7. now							--	17	59	74	-06	37	21	57	57	63
							--	16	50	69	-35	33	14	56	40	62
8. sharp								--	02	28	-03	38	30	26	23	11
								--	04	35	-36	46	53	21	17	15
9. good									--	69	-13	29	20	87	62	66
									--	62	-17	19	09	93	32	76
10. important										--	-02	50	32	69	79	72
										--	-18	52	35	77	67	79
11. always the same											--	25	10	-22	-36	-36
											--	-07	-09	-21	-25	-29
12. strong												--	79	16	50	32
												--	83	32	58	24
13. fast													--	19	35	31
													--	20	42	14
14. happy														--	59	69
														--	47	80
15. true															--	71
															--	52
16. close																--
																--

TABLE 13.-Intercorrelation matrices, ninth grade.

Scale	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. large	9M--	01	30	02	-16	52	25	13	19	26	17	71	61	15	20	12
	9F--	14	05	-23	-42	67	17	18	-17	03	21	65	49	-20	-06	-23
2. hot		--	-02	-02	03	28	27	40	-28	23	12	25	20	-12	-12	-04
		--	05	03	-04	-04	22	61	-17	27	05	28	36	-12	-06	02
3. real			--	48	38	05	74	27	59	80	-16	52	41	65	93	83
			--	38	17	04	76	12	38	69	-37	59	44	40	91	58
4. clean				--	38	01	46	51	90	61	-05	07	11	93	57	67
				--	37	-30	47	47	95	71	-11	17	18	93	59	83
5. my very own					--	07	35	19	43	34	-04	13	04	41	34	54
					--	-45	17	04	37	29	-03	-10	-09	29	22	52
6. thick						--	19	-04	07	16	16	43	21	-04	-03	08
						--	-08	-02	-25	-22	01	29	06	-29	-10	-34
7. now							--	28	49	78	17	47	42	53	70	69
							—	22	43	77	-20	51	42	47	69	64
8. sharp								--	29	42	-21	39	48	53	27	30
								--	32	46	-13	44	49	38	20	34
9. good									--	67	02	18	18	91	64	77
									—	72	-09	17	14	96	62	84
10. important										--	12	53	49	72	77	84
										--	-09	51	41	75	80	83
11. always the same											--	21	13	-03	-05	-16
											—	06	12	-07	-25	-25
12. strong												--	87	27	46	29
												--	88	19	54	20
13. fast													--	27	39	28
													--	12	38	15
14. happy														--	75	75
														--	67	81
15. true															--	77
															--	72
16. close																--
																--

TABLE 14.-Centroid factor matrices, third grade.

Scale		FI	FII	FIII	FIV	FV	h^2
1. large	3M	35	70	29	-21	12	76
	3F	34	-59	16	40	-28	73
2. hot		23	36	20	41	-17	42
		32	-41	52	-40	14	72
3. real		71	06	-44	-25	17	79
		66	-24	-53	-22	-26	89
4. clear		74	-39	41	24	08	93
		68	64	08	13	04	90
5. my very own		[illegible]	-24	-40	40	-11	49
		21	50	-15	-40	33	59
6. thick		26	54	30	-14	14	49
		07	-50	14	-08	-09	29
7. now		70	-42	-20	-26	-31	87
		64	41	24	07	-32	74
8. sharp		-08	65	-23	38	06	63
		46	-50	42	-32	36	87
9. good		77	-47	38	-10	07	97
		63	68	-07	30	-07	96
10. important		93	-14	11	10	-28	98
		86	27	03	-09	-14	84
11. always the same		26	30	-11	-09	-38	32
		18	-15	31	12	12	18
12. strong		74	66	-10	12	05	101
		72	-56	-20	34	08	99
13. fast		59	55	-13	22	23	77
		52	-50	-30	33	26	79
14. happy		86	-33	21	19	21	97
		77	49	16	16	18	92
15. true		73	-06	-41	-14	32	83
		74	-17	-49	-16	-15	90
16. close		71	-59	-23	08	06	92
		40	68	-34	-18	-11	78
% of total variance		38	20	08	05	04	75
		31	23	09	07	05	75
% of common variance		50	27	11	07	05	100
		42	31	12	09	06	100

TABLE 15.-Centroid factor matrices, sixth grade.

Scale		FI	FII	FIII	FIV	FV	h^2
1. large	6M	34	69	33	31	-13	81
	6F	25	-70	08	48	10	80
2. hot		14	57	-40	-16	13	55
		41	-49	29	-28	-45	77
3. real		83	-18	22	-27	-23	90
		73	13	-63	09	-24	101
4. clean		71	-32	-39	33	07	87
		74	39	37	-14	20	90
5. my very own		38	-27	-13	-24	19	33
		20	50	12	-25	13	38
6. thick		27	46	-14	29	-33	50
		11	-47	14	29	-25	40
7. now		70	-19	10	14	05	56
		67	19	12	12	-22	56
8. sharp		49	44	-56	-22	10	81
		55	-50	16	-54	-06	87
9. good		71	-44	09	42	09	89
		64	53	27	17	36	92
10. important		85	-19	16	05	19	82
		86	20	09	14	-10	82
11. always the same		-13	42	14	32	24	37
		-35	-07	06	26	24	26
12. strong		67	58	43	-08	13	99
		71	-54	-26	25	30	101
13. fast		51	41	38	-21	23	67
		53	-44	-36	-14	40	78
14. happy		73	-46	-16	28	20	89
		77	49	21	07	26	95
15. true		83	-27	23	-23	-32	97
		72	13	-58	14	-20	93
16. close		75	-42	07	-16	14	79
		72	54	08	03	03	82
% of total variance		37	18	08	06	04	73
		36	19	09	06	06	76
% of common variance		51	24	11	09	05	100
		48	25	11	08	08	100

TABLE 16.--Centroid factor matrices, ninth grade.

Scale		FI	FII	FIII	FIV	FV	h^2
1. large	9M	44	-54	22	24	-38	74
	9F	-12	75	27	38	09	80
2. hot		17	-42	-22	-39	38	55
		21	43	-56	14	-27	64
3. real		81	30	39	08	22	95
		72	31	34	-45	-07	94
4. clean		69	43	-47	18	-14	93
		84	-34	11	35	-09	96
5. my very own		42	30	-17	-22	12	36
		40	-41	-18	-13	18	41
6. thick		28	-44	-08	-25	-31	44
		-33	51	46	21	-27	70
7. now		80	05	18	-33	05	79
		72	29	23	-18	04	69
8. sharp		50	-11	-38	27	48	71
		51	26	-34	45	-37	78
9. good		73	48	-18	19	-35	95
		78	-38	30	37	08	99
10. important		90	12	12	-19	05	88
		91	15	11	06	10	88
11. always the same		06	-22	10	-21	-30	20
		-21	05	-09	31	43	34
12. strong		70	-62	25	13	08	96
		46	79	10	15	22	92
13. fast		63	-55	23	27	17	85
		44	69	-19	16	23	78
14. happy		80	42	-25	29	-10	97
		80	-33	27	33	03	93
15. true		79	36	36	14	09	91
		83	14	38	-27	04	93
16. close		80	47	08	-12	12	90
		89	-29	16	02	05	90
% of total variance		41	16	07	05	06	75
		40	19	08	08	04	79
% of common variance		55	21	09	07	08	100
		50	24	11	10	05	100

TABLE 17.-Rotated factor matrices, third grade.

Scale		FI	FII	FIII	FIV	FV	h^2
1. large	3M	-02	73	04	-48	-01	77
	3F	-06	-55	17	62	-10	73
2. hot		08	46	42	14	-01	41
		-03	-07	84	09	-04	72
3. real		46	41	-61	07	-15	78
		23	-37	05	-04	-83	88
4. clean		92	08	24	-05	18	95
		94	-02	-02	-07	02	89
5. my very own		34	04	-09	61	-06	50
		40	23	08	-59	-09	58
6. thick		-01	56	08	-40	06	48
		-26	-19	32	24	-13	28
7. now		73	-06	-29	06	-48	85
		79	07	10	31	-13	75
8. sharp		-41	59	08	31	11	63
		01	-33	87	-06	-00	87
9. good		95	-03	02	-26	03	97
		94	-07	-26	00	-01	96
10. important		87	34	10	07	-31	98
		80	-15	23	06	-35	84
11. always the same		04	34	02	02	-46	33
		09	-19	27	15	20	18
12. strong		27	96	-09	04	-08	101
		18	-91	19	18	-28	101
13. fast		20	83	-11	11	14	77
		04	-87	07	-04	-17	79
14. happy		95	20	-00	01	20	98
		92	-19	14	-08	09	92
15. true		55	35	-62	11	04	82
		35	-40	05	-01	-78	89
16. close		85	-10	-30	29	-02	91
		67	23	-26	-29	-34	77
% of total variance		35	22	08	07	04	76
		30	17	12	07	11	77
% of common variance		46	30	10	09	05	100
		40	21	16	09	14	100

TABLE 18.-Rotated factor matrices, sixth grade.

Scale		FI	FII	FIII	FIV	FV	h^2
1. large	6M	-00	78	-06	09	-42	80
	6F	-11	-85	02	-12	-20	79
2. hot		-16	25	-68	06	-02	55
		03	-18	-05	-83	-24	78
3. real		73	30	-02	-52	04	90
		33	-12	-94	-06	01	101
4. clean		83	-17	-28	18	-22	88
		92	01	02	-20	10	90
5. my very own		43	-08	-17	-10	30	32
		48	36	03	03	18	39
6. thick		03	30	-28	-02	-57	49
		-16	-42	-01	-23	-38	40
7. now		72	20	01	-01	-05	56
		60	-09	-30	-21	-26	57
8. sharp		19	19	-85	-05	-02	80
		15	-24	-07	-85	25	87
9. good		90	02	17	18	-16	90
		94	-08	02	19	06	93
10. important		84	31	-04	-00	10	81
		75	-20	-37	-21	-17	81
11. always the same		-23	34	01	43	-11	37
		-21	-15	28	33	-00	25
12. strong		29	94	-15	-07	03	100
		22	-86	-39	-17	20	101
13. fast		22	74	-11	-06	23	66
		11	-56	-35	-23	53	78
14. happy		91	-11	-08	19	-02	88
		96	-06	-12	04	07	95
15. true		77	24	05	-56	-02	97
		35	-16	-88	-03	-01	92
16. close		83	06	-02	-18	25	79
		86	09	-29	-00	-03	83
% of total variance		36	17	09	06	05	73
		31	14	15	12	05	77
% of common variance		50	23	12	08	07	100
		41	19	19	15	06	100

TABLE 19.-Rotated factor matrices, ninth grade.

Scale		FI	FII	FIII	FIV	FV	h^2
1. large	9M	11	-77	-20	22	-19	73
	9F	-16	77	03	09	-41	80
2. hot		-10	-26	-04	-64	22	54
		-05	31	-72	-02	12	63
3. real		84	-27	41	-01	-02	95
		47	25	03	-81	-03	94
4. clean		82	09	-41	07	26	92
		96	-07	-16	06	-02	96
5. my very own		50	14	-05	-28	06	35
		40	-25	02	-04	42	40
6. thick		00	-43	-38	-24	-24	44
		-29	36	07	-03	-69	70
7. now		70	-33	08	-38	-19	79
		54	35	-02	-53	03	70
8. sharp		36	-26	-04	-15	69	70
		41	27	-72	11	-11	78
9. good		89	03	-33	24	-04	96
		98	-03	10	10	-05	98
10. important		82	-34	05	-28	-09	88
		79	35	-12	-31	12	87
11. always the same		-06	-20	-17	-09	-34	20
		-11	26	20	43	18	34
12. strong		27	-93	06	-11	05	96
		23	89	-11	-25	-03	92
13. fast		25	-86	13	-01	19	86
		18	80	-27	-14	18	80
14. happy		91	-05	-23	18	22	96
		96	-02	04	04	-05	93
15. true		87	-21	32	10	-06	92
		68	23	10	-63	01	92
16. close		92	-00	14	-17	-02	90
		91	-05	00	-23	14	90
% of total variance		39	18	05	06	06	74
		36	18	08	11	06	79
% of common variance		52	25	07	08	08	100
		46	22	10	14	08	100

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