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The Relationship of Verbal Abilities to Cognitive Complexity

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The Relationship of Verbal Abilities to Cognitive Complexity

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Introduction

A view of the person as an individual striving to anticipate, understand, and control his environment was put forth by Kelly (1955) in his Psychology of Personal Constructs. Kelly states that the person looks at the world through "patterns or templates which he creates and then attempts to fit over the realities of which the world is composed" (p. 9). These templates or patterns are termed constructs, and result from the person's ability to distinguish differences and similarities in the world about him and generalize them to other instances. Constructs are used to predict events and to assess the validity of the forecasts. Because of this constant prediction and assessment of prediction, construct systems are subject to revision and change through time, as predictions are either proved accurate or in error by events.

The term "cognitive complexity" was introduced by Bieri (1955) in connection with Kelly's theory of personal constructs. Bieri (1966) defines cognitive complexity as "the tendency to construe social behavior in a multidimensional way, such that a more cognitively complex individual has available a more versatile system for perceiving the behavior of others than does a less cognitively complex person" (p. 14). For Crockett (1965) a cognitive system would be considered complex if it meets two criteria. First, it must contain a relatively high number of elements and secondly, it must be well integrated into hierarchical relations among the constructs or elements.

The study of cognitive complexity rests on several basic assumptions: 1) personal constructs are relatively stable through time (Levy & Dugan, 1956), 2) constructs are used to structure the social environ-

ment, and 3) the social environment can be replicated by the knowledge of the personal construct system.

Investigators have also assumed that the more differentiated, more complex individual (having a more versatile construct system) has more alternative behaviors available to him (Bieri & Blacker, 1956).

The majority of measuring devices used in evaluating personal construct systems appear to measure the number of different constructs in the system or the way an individual uses his constructs in viewing others in his social environment and do not ascertain the integration within the construct system. Such indices actually obtain a measure of an individual's cognitive differentiation (Bannister & Mair, 1968). For the purposes of this paper, however, such differentiation measures will be subsumed under the term cognitive complexity.

Many methods have been developed to obtain a sample of an individual personal construct system. One of the most frequently used techniques is some form of Kelly's (1955) Role Construct Repertory (Rep) Test. Construct-contrast pairs (e.g. happy-sad) are either provided by the experimenter (Tripodi & Bieri, 1963) or elicited by means of the "triad method". The triad method requires the respondent to consider the personalities of persons conforming to three provided role categories (e.g. brother, spouse, and boss) and think of a way in which any two of the persons are alike but different from the third person. The respondent compares various groupings of three until the specified number of construct-contrast pairs are elicitied. The respondent then is required to rate a number of known individuals on each of the construct-contrast pairs. Construct ratings are compared to see if they yield a similar

pattern of ratings across individuals; the higher the degree of pattern similarity, the less differentiated or complex the subject is considered to be.

Another popular method of assessing cognitive complexity is the Role Category Questionnaire (Crockett, 1965). This test requires a respondent to describe several known individuals in writing. The descriptions are analyzed as to the number of different personality traits or constructs used, with fewer constructs constituting lower complexity. However, Miller (1967) has pointed out that this method of measuring complexity contrasts greatly with Rep test procedures. The Role Category Questionnaire appears to be measuring a person's ability to generate different constructs, whereas the Rep test estimates the "degree of equivalence among these constructs in the subject's construing of other people" (Miller, 1967, p. 142). Although Crockett (1965) asserts that the "number of constructs and the extent to which the constructs differentiate among the subject's associates are highly correlated" (p. 51), this assumption has not been subjected to empirical investigation.

Both the Rep test procedure and the free description technique (Role Category Questionnaire) have their advantages and disadvantages. Livesley and Bromley (1973) state that although the Rep test assumes that the relationships between constructs and stimulus persons being judged are independent, cognitive structure is probably organized as an interaction taking both the stimulus person and the construct dimension into account, "for example, 'careful with his money' might imply 'miserliness' in a rich person or 'sensible' in a student or newlywed" (p. 41). Further, the Rep procedure does not study the usage of con-

structs in a naturalistic manner as does the free description method (Bannister & Mair, 1968; Livesley & Bromley, 1973). Also, Rep procedures which provide constructs rather than eliciting them do not take into account the possibility that the same set of constructs may not be used the same way by all persons (Bannister & Mair, 1968). Rep tests that use ranking of the construct-contrast pairings across roles have one advantage, however. They overcome the difficulties of response sets found in bipolar ratings (Livesley & Bromley, 1973; Leitner, Landfield, & Barr, Note 2).

One advantage of free description techniques (Crockett, 1965) is that they are more naturalistic than Rep procedures, and they allow the respondent relatively free range in choosing his or her subject matter. In addition, such procedures avoid the problems associated with providing constructs while allowing analysis of the written descriptions in terms of their content, structure, and usage of particular constructs across differing populations (Livesley & Bromley, 1973). However, it should be recognized that free description may be related in some manner to the respondent's vocabulary, verbal, and writing skills in addition to writing speed (Leitner, Landfield, & Barr, Note 2).

Crockett (1965) recognized that verbal skills could have an influence on the number of constructs generated by means of a free description technique and imposed a time limit for each of eight descriptions in the hope of minimizing these effects. More recently, Crockett (Note 1) requires respondents to write only four descriptions with a time limit of 5 minutes for each. Separate distributions are prepared for male and female subjects (Crockett, Note 1) because females use significantly

more constructs in their descriptions than do males in spite of time limitations imposed. Miller (1967) suggests that one explanation for these findings is that females have a tendency to write longer descriptions than do males.

If verbal abilities are related to free description measures of complexity, one would expect consistent sex differences with females outscoring males in most instances. In this regard, Maccoby and Jacklin (1974) report consistent sex differences in verbal skills beginning at the age of 10 or 11 and continuing through the college years. Females score higher on many types of verbal tasks, including "comprehension of complex written text, quick understanding of complex logical relations expressed in verbal terms, and in some instances of verbal creativity of the sort measured by Guilford's tests of divergent thinking" (Maccoby & Jacklin, 1974, p. 84).

Several types of divergent thinking processes have been discussed by Guilford (1963): "Word fluency" is characterized as the ability to produce words meeting certain specified structural requirements (e.g. listing words beginning with the letter S), and "associational fluency" is characterized by the ability to list words having specified requirements of meaning, such as synonyms or antonyms. "Ideational fluency" is considered to be the ability to produce ideas meeting certain requirements of meaningfulness (e.g. listing ways to use a brick); "expressional fluency" is the ability to put ideas into sentences with certain structural requirements (e.g. writing as many four word sentences as possible, with the first word beginning with the letter D, the second word with the letter G, the third with the letter R, and the fourth with

the letter A). Guilford (1963) suggests that these fluency variables should contribute to an increased writing ability.

Since at least some measures of cognitive complexity could be influenced by different kinds of verbal abilities (Crockett, 1965) the present study investigated the relationship among various measures of verbal skills and cognitive complexity. Several types of fluency tasks of the sort measured by Guilford (1963) were included as well as a number of measures of verbal aptitude (vocabulary and verbal reasoning), even though previous research has found no significant relationship between intelligence measures and interpersonal cognitive complexity using either rating procedures or free description techniques (Crockett, 1965).

The Remote Associates Test (RAT: Mednick, 1967) was included in the study as a measure of creative thinking. Although the RAT is a test of convergent thinking in the strict sense, Wallach (1970) considers its resemblance to other measures of convergent thinking to be a superficial one because of the heavy dependence of the RAT on associative processes.

Two measures of writing skills were included in the present study as well: mean sentence length and the number of one-syllable words used in free description. Does the person who writes longer sentences view others in a complex manner? Does the person who uses a large number of one-syllable words in describing others view the world in a simplistic manner, or does she just have fewer words at her disposal?

Besides the free description technique and the Rep procedure of measuring cognitive complexity, a third method of assessing cognitive complexity was considered. It was based on a combination of the Rep

procedure and the Number of Different Perceptions Measure developed by Bieri and Blacker (1956). Construct-contrast pairs were elicited using the triad method described above, but respondents were allowed to list as many constructs for each triad grouping as they wished. The complexity score was obtained by counting the number of different construct-contrast pairs generated. Because this method emphasizes productivity, it was hypothesized that it would correlate with the free description technique at a higher level than the complexity score obtained on a standard Rep test in which the similarity of rating patterns is emphasized.

Measures and Hypotheses

Measures

1) Role category questionnaire. The first measure of cognitive complexity was a modification of Crockett's (1965) Role Category Questionnaire. The respondents described in writing four people who best corresponded to four role categories: "two males and two females, one liked and one disliked for each sex--taking 5 minutes for each such description" (Crockett, Note 1). Each respondent was asked to describe persons approximately his own age. Responses were written in essay form and respondents were instructed to use complete sentences in their descriptions so that sentence length could be determined from the descriptions. The role categories were presented in a randomized order.

Responses were scored on the number of constructs generated across the four person descriptions. Miller (1967) outlined Crockett's scoring procedures as follows:

> We have defined an interpersonal construct as any trait described either with a word or a phrase, which refers to some one attribute in the person who is being described. (p. 145)

Repetitions across descriptions of exactly the same attribute were not scored. An interrater reliability coefficient of .86 was obtained between the author and a second person on 30 protocols selected at random from the total number of tests scored by the author alone.

2) Number of different constructs. A modification of Kelly's (1955) Rep test similar to the one used by Bieri and Blacker (1956) was administered. A triad method was used to generate construct-contrast pairs. Care was taken to assure that each construct referred to some personality characteristic as opposed to constructs referring to physical attributes and demographic characteristics. Respondents were given the added instruction that if more than one construct-contrast pair came to mind for a given triad, they were to indicate them as well. No upper limit was set by the experimenter on the number of constructs generated, and respondents were allowed to use the same construct more than once if it applied to more than one triad grouping. The order of the triads used for elicitation was randomized across respondents. The complexity score consisted of the number of different construct-contrast pairs generated.

3) Role construct repertory test (Kelly, 1955). Respondents were asked to use the first 12 different construct-contrast pairs generated in the elicitation procedure above to rate persons assigned to each of the 12 role categories on a 7 point scale.

Scores were determined by a method in which the rating of each of the 66 pairings of the 12 triad dimensions are compared for similarity of usage across role categories and summed to give a total differentiation (complexity) score (Millimet, Note 3). A low score on this measure indicates greater complexity in the subject.

4) Minimal terminable units. Mean sentence length has often been used as a measure of writing development or writing fluency (Nunnally, 1961; Hunt, 1965). However, the defintiion of what is to be considered a sentence has caused some disagreement (Hunt, 1965). Indices of sentence length as determined by end punctuation can be influenced by the use of multiple conjunctions or incorrect punctuation. Measures of clause length seem to be more operationally sound indices of writing fluency. A promising measure of clause length which preserves subordinate clauses is the minimal terminable unit or T-unit. Such a unit contains "one main clause with all the subordinate clauses attached to it" (Hunt, 1965, p. 20).

One of each subject's person descriptions on the Role Category Questionnaire (Crockett, 1965) was chosen at random, and the first 100 words of it were analyzed for the mean number of T-units. The randomization of the liked and disliked roles in the person descriptions assured that T-units would not be counted on only liked or disliked males or females.

5) One-syllable words. In studying the stylistic features of messages, Nunnally (1961) found several factors which influenced reading ease. Sentence difficulty, measured by mean sentence length constituted one factor, while word difficulty constituted a second factor. The

average number of one-syllable words loaded .89 on the second factor (Nunnally, 1961).

Scores on this variable were determined by counting the number of one-syllable words produced in the 100 word description analyzed above for T-units,[1] the higher the score on this variable, the greater the reading ease of the description.

6) Purdue vocabulary. Respondents were given Part 6 of the New Purdue Placement Test in English (Remmers, Franklin, Wikoff, & McKee, 1955). The test requires subjects to check off a synonym for a stimulus word from among five alternatives. There are 45 words with a time limit of 11 minutes.

7) Nelson-Denny vocabulary. Respondents were given the vocabulary section of the Nelson-Denny Reading Test (Nelson & Denny, 1960). The test requires subjects to choose from among five alternatives the item best completing a stimulus phrase (e.g., A linguist is trained in... a) art b) law c) language d) writing e) history). The vocabulary section consists of 100 items with a time limit of 10 minutes.

This variable was included in the present study as a second measure of general vocabulary skills. In pilot work by the author, the expected correlation between the vocabulary section of the New Purdue Placement Test in English and verbal reasoning was not demonstrated for males. The vocabulary section of the Nelson-Denny was included as another measure of this verbal aptitude.

8) Verbal reasoning. Respondents were given the Verbal Reasoning section of the Differential Aptitude Tests (Bennett, Seashore, & Wesman, 1973). This measure gives give alternatives for analogies in the form

"_____ is to A as B is to _____". Respondents were limited to 20 minutes for completion of the test. Vocabulary and verbal reasoning were included in the study because they are often used as measures of verbal intelligence (Vernon, 1971).

9) Remote associates test. This test was developed by Mednick (1967) as a measure of creativity. Respondents are presented with three words and asked to find a fourth word which is related to all three stimulus words. For example, the correct solution to the stimulus words "rat, cottage, and blue" is the word "cheese". Guilford (1963) has stated that the ability measured by the Remote Associates Test (RAT) is a form of "associational fluency". Neither intelligence nor achievement have been found to correlate highly with the RAT (Wallach, 1970).

Subjects in this study responded to a shortened version of the adult RAT. Twenty items were chosen at random from the 30 item RAT, and the time limit was reduced proportionately. Results were scored for the number of correct solutions.

10) Word fluency. Guilford (in Wallach, 1970) and Vernon (1971) have defined word fluency as the ability to generate words fulfilling particular structural requirements. In this test subjects were asked to write as many words beginning with the letter M as they could in 5 minutes (Thurstone & Thurstone, 1949). This task measures the ability to produce words containing one structural restriction without reference to word meaning.

11) Scrambled letters anagrams. Anagram solution has been considered another type of word fluency (Wallach, 1970). Interestingly, Gavurin (1972a) has reported that the solution of anagrams is associated more

with nonverbal than verbal skills. Gavurin found that successful anagram solution was more closely related to the Numerical Ability subtest of the Differential Aptitude Tests than to the Verbal Reasoning subtest. On the other hand, Wilson, Guilford, Christensen, and Lewis (1954) found that anagram problem solving includes word fluency abilities (on which females outscore males) as well as numerical (Gavurin, 1972a) or spatial abilities (on which males outscore females). In this regard, Mendelsohn and Covington (1972) found that males performed better than females on orally presented anagrams, whereas no sex difference was noted in performance with the normal visual presentation. Mendelsohn and Covington concluded that "a somewhat different weighting of abilities underlies anagram solving for males and females, the strengths of one sex being offset by those of the other" (p. 467).

Respondents were given 12 five-letter anagrams chosen from a list prepared by Ronning (1965). Six of the anagrams are considered easier because of their high frequency of certain letter combinations and six are considered harder due to their use of low frequency letter combinations. The anagrams were type-written on a single page and a time limit of 18 minutes was imposed so that the test could be administered to a group. Although respondents have been found to express a perference for anagram solution which allows for letter manipulation, no differences in test results were found between instructions allowing for anagram manipulation and instructions allowing for no manipulation (Gavurin, 1972b). Consequently, subjects were allowed to manipulate the letters of the anagrams in the present study.

12) <u>"Generation" anagram task</u>. Although an anagram task usually

involves the presentation of a set of jumbled letters from which the respondent must arrive at a one word solution, the present task required the respondents to form as many four or more letter words from the stimulus word "generation" as they could in 5 minutes (Mednick, 1963). Mednick has found that the quantity of words formed on this task correlates with the RAT (r=.44). Scoring was based on the number of different words produced in the time alloted.

13) Alternate uses test. The Alternate Uses Test was developed as a measure of ideational fluency. Ideational fluency is a form of divergent thinking which can be characterized by the ability to generate ideas fulfilling certain requirements within a limited time (Guilford, 1963). Respondents were given a four-item modification of Wallach and Kogan's (1965) Alternate Uses Test. They were asked to write as many different uses for each of the items "shoe, coathanger, chair, and string" as they could in a period of 8 minutes. Scoring was based on the number of uses generated on the four combined items (Wallach, 1970).

14) ACT test of English usage. In his review of the ACT Wallace (1972) stated that "the tests display highly satisfactory predictive validities against criteria of college grades" (p. 615). The ACT test of English usage asks the student to select the most appropriate expression in standard written English from among four alternatives. As ACT scores for students entering the University of Nebraska at Omaha are on file with the University, scores on the English usage subtest were obtained from student records as a measure of general verbal aptitude.

The tests administered in the present study included three measures of cognitive complexity and eight separate measures of verbal abilities.

In addition, two measures of writing fluency were analyzed from the writing sample taken from the Role Category Questionnaire. Table 1 presents the 14 variables included in the study as well as the type of verbal skill each measures.

Table 1

Measures of Cognitive Complexity and Verbal Skills

Measure	Type of task	Ability indicated
Role Category Questionnaire	Productive	Complexity: Number of constructs
Number of Different Constructs	Productive	Complexity: Number of constructs
Rep test	Productive	Complexity: Rating similarity
T-units	Productive	Writing fluency
One-syllable words	Productive	Reading ease
Purdue Vocabulary	Responsive	Verbal intelligence
Nelson-Denny Vocabulary	Responsive	Verbal intelligence
Verbal Reasoning	Responsive	Verbal intelligence
Remote Associates Test	Productive	Associational fluency-creativity
Word fluency (M words)	Productive	Word fluency
Scrambled letters anagrams	Responsive	Word fluency-spatial ability
"Generation" anagram task	Responsive	Word fluency-spatial ability
Alternate Uses Test	Productive	Ideational fluency
ACT (English subtest)	Responsive	Verbal aptitude

After considering previous research (e.g., Guilford, 1963: Preston & Gardner, 1967), and pilot data by the author, the following hypotheses were proposed. The 14 measures of the study should identify three primary factors: 1) a verbal ability factor, defined by the two vocabulary meausres, one-syllable words, verbal reasoning, and the ACT; 2) a verbal fluency factor, defined by word fluency, scrambled letters anagrams, the "generation" anagram task, and the Alternate Uses Test; and 3) a cognitive complexity factor, defined by the Number of Different Constructs, the Rep test, and the Role Category Questionnaire.

Method

Subjects

Subjects for this experiment consisted of 61 male and 83 female introductory psychology students at the University of Nebraska at Omaha.[2] All subjects were between the ages of 17 and 23 and received course credit for their participation.

Procedure

Two sessions of approximately 2½ hours each were held for groups of respondents ranging in size from 5 to 20 persons. The measures were administered in the same order for all groups. Session I consisted of: 1) Role Category Questionnaire 2) Scrambled letters anagrams 3) Purdue vocabulary 4) Word fluency (M words) 5) Number of Different Constructs. Session II consisted of: 1) Verbal Reasoning 2) RAT 3) Alternated Uses Test 4) Nelson-Denny vocabulary 5) "Generation" anagram task 6) Rep test. The order of presentation was designed so that longer, more difficult tests were near the beginning of each session and so that similar tests were not presented in the same session. Testing sessions were held

approximately one week apart. At the end of the second session, respondents were thanked for their participation and informed of the nature of the study.

Results and Discussion

Table 2 presents the means, standard deviations, and the t tests performed on the means for each of the 14 variables for males and females. Four of the t tests proved to be significant at the .05 level or better.

Table 2

Means and Standard Deviations of Male and Female Subjects on 14 Verbal Measures

	Female			Male			
Variable	n	M	SD	n	M	SD	t
Role Category Questionnaire	82	31.21	8.37	60	25.98	7.85	3.75***
Number of Different Constructs	83	16.54	4.56	61	15.85	4.94	.87
Rep Test	83	14.09	4.89	61	12.71	3.02	1.96*
T-units	83	14.78	2.47	59	14.25	2.88	1.18
One-syllable words	83	73.65	5.85	60	73.95	6.30	.29
Purdue Vocabulary	83	16.76	6.93	61	19.13	7.35	2.00*
Nelson-Denny Vocabulary	83	33.35	11.07	61	34.70	11.10	.73
Verbal Reasoning	83	32.04	9.56	61	33.79	9.58	1.09
Remote Associates Test	83	8.60	3.08	60	8.10	2.83	.99
Word Fluency	83	41.88	9.69	61	39.49	9.18	1.61
Scrambled letters anagrams	83	9.63	2.13	61	9.51	2.20	.33
"Generation" anagram task	83	15.83	5.44	61	13.66	5.39	2.39**
Alternate Uses Test	82	19.55	5.06	61	18.74	5.84	.88
ACT (English subtest)	65	18.08	5.17	52	16.88	5.28	1.23

*$p<.05$
**$p<.02$
***$p<.001$

Consistent with a finding reported by Crockett (1965) females produced significantly more constructs in their person descriptions than did males. However, upon further investigation, and consistent with Miller's (1967) concern, it was noted that females ($\bar{X}$= 180.7 words) wrote significantly longer descriptions than males ($\bar{X}$= 155.5 words; t (143) = 3.42; $p<.001$). This result undoubtedly contributed to the highly significant difference found in the number of constructs generated by the two sexes.

Females obtained significantly higher scores on the "Generation" anagrams task, a task involving word fluency. Indeed, previous research has shown that females are superior on some tests of divergent thinking, especially fluency tasks (Maccoby & Jacklin, 1974).

Curiously, although males scored significantly higher than females on the Purdue vocabulary test, no sex difference was found on the Nelson-Denny vocabulary. Maccoby and Jacklin (1974) report that no consistent sex differences in vocabulary tests have been found for college age subjects.

The fourth variable to reflect a significant sex difference in this study was the Rep test procedure. Males were shown to be significantly more complex than females. That is, they showed a lesser degree of pattern similarity of construct ratings across the 12 role categories than did females. Sex differences in cognitive differentiation have not been reported in the literature. Further research in this area is indicated.

Analysis for Males

Table 3 presents the Pearson product-moment correlation coefficients among the 14 variables for males. The intercorrelations were analyzed

Table 3

Correlation Matrix: Males

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1) Role Category Questionnaire	X													
2) Number of Different Constructs	.33	X												
3) Rep test	-.11	-.17	X											
4) T-units	.14	-.01	.06	X										
5) One-syllable words	-.05	.01	.02	.41	X									
6) Purdue Vocabulary	.36	.25	.08	-.14	.25	X								
7) Nelson-Denny Vocabulary	.31	.30	.04	-.11	-.24	.80	X							
8) Verbal Reasoning	.49	.34	.13	-.09	-.24	.70	.77	X						
9) Remote Associates Test	.33	.21	.20	-.04	-.32	.50	.49	.64	X					
10) Word Fluency	.31	.15	-.08	.16	-.01	.12	.21	.35	.28	X				
11) Scrambled Letters anagram	.32	.18	-.01	-.03	-.12	.33	.50	.56	.45	.45	X			
12) "Generation" anagram task	.31	.11	.12	-.06	-.20	.33	.44	.47	.31	.47	.62	X		
13) Alternate Uses Test	.44	.08	-.21	.06	-.05	.15	.22	.26	.27	.33	.20	.29	X	
14) ACT (English subtest)	.47	.26	.12	-.03	-.05	.58	.58	.68	.67	.27	.40	.33	.16	X

$p<.05 = .25$

$p<.01 = .32$

by means of a principal components factor analysis. Four factors yielding eigenvalues greater than 1.0 accounted for 52.1% of the total variance. These factors were rotated by means of a varimax rotation solution. The rotated factor matrix is presented in Table 4.

Table 4

Rotated Factor Matrix: Males

Variables/factors	I	II	III	IV	h^2	Total
Role Category Questionnaire	.47	.31	.19	.37	.49	
Number of Different Constructs	.35	.06	.04	.28	.20	
Rep test	.15	.03	.09	-.67	.48	
T-units	-.03	.08	.64	-.01	.42	
One-syllable words	-.15	-.11	.59	-.01	.38	
Purdue Vocabulary	.79	.08	-.24	.01	.69	
Nelson-Denny Vocabulary	.76	.24	-.24	.04	.69	
Verbal Reasoning	.83	.36	-.12	.01	.83	
Remote Associates Test	.64	.30	-.10	-.08	.52	
Word Fluency	.14	.63	.16	.17	.47	
Scrambled letters anagrams	.36	.64	-.10	.01	.55	
"Generation" anagram task	.24	.75	-.16	-.06	.65	
Alternate Uses Test	.17	.36	.06	.38	.30	
ACT (English subtest)	.76	.22	.07	.02	.63	
% Total Variance	24.95	13.87	7.19	6.02		52.1
% Common Variance	47.94	26.66	13.81	11.58		100.0

Factor I was defined by Verbal Reasoning (.83), the Purdue Vocabulary (.79), the Nelson-Denny Vocabulary (.76), the ACT (.76), and the

RAT (.64). The Role Category Questionnaire loaded moderately (.47) on Factor I as well. Although Vocabulary, Verbal Reasoning, and the ACT are all used as measures of verbal intelligence, the high loading of the RAT suggests that there is some component of associational fluency or creativity involved in Factor I as well. For this reason, Factor I has been termed Verbal Aptitude, and it accounted for 25% of the total variance.

Support for the position that performance on Crockett's (1965) Role Category Questionnaire is at least partially a function of verbal ability is shown by this measure's moderate loading on Factor I. Thus, males scoring high in verbal aptitude are more likely to score high on the Role Category Questionnaire as well.

Factor II was defined by three measures of verbal fluency: the "Generation" anagram task (.75), the Scrambled Letters anagrams (.64), and Word Fluency (.63). As these measures deal with either the production or manipulation of words having structural restrictions, Factor II was labeled Verbal Fluency and accounted for 13.9% of the total variance.

T-units (.64) and One-syllable words (.59) defined Factor III. The mean number of one-syllable words has been found to be a measure of reading ease (Nunnally, 1961), and the hypothesis that it would load with the responsive measures of vocabulary was not supported by the present study. The fact that it defined the same factor as T-units may be the result of using the same writing sample to estimate both variables. That is, the relative length of the sentences was determined in part by the number of one-syllable words (function words) in them. Since both of the measures loading on Factor III appear to reflect writing ability,

Factor III was called Writing Fluency and accounted for 7.2% of the total variance.

Factor IV was determined by only one variable, the Rep test (.67). This measure of cognitive complexity was designed to determine the similarity of pattern usage of personality constructs across role categories. Since the other two measures of cognitive complexity did not load on this factor, Miller's (1967) criticism of complexity indices seems justified. The Rep test does not take into account either the number of constructs at the subject's disposal or the integration of constructs into his perceptual system. The three measures of cognitive complexity included in this study apparently estimate different components of personality. Factor IV accounted for 6% of the total variance and was labelled Cognitive Differentiation.

Analysis for Females

The Pearson product-moment correlation coefficients among the 14 variables for females are presented in Table 5. The intercorrelations were subjected to a principal components factor analysis. Four factors yielding eigenvalues greater than 1.0 accounted for 47.5% of the total variance. The factors were rotated by means of a varimax rotation solution. The rotated factor matrix for females is presented in Table 6.

Factor I was defined by the Nelson-Denny Vocabulary (.84), the Purdue Vocabulary (.83), the ACT (.61), Verbal Reasoning (.56), the RAT (.50), and Scrambled letters anagrams (.46). The major component of Factor I seems to be vocabulary, but it includes other kinds of verbal skills as well. The ACT and Verbal Reasoning would be considered indicators of general intelligence and predicators of school success.

Table 5

Correlation Matrix: Female

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1) Role Category Questionnaire	X													
2) Number of Different Constructs	.20	X												
3) Rep Test	-.15	-.07	X											
4) T-units	-.20	-.11	-.16	X										
5) One-syllable words	-.10	-.07	-.08	.11	X									
6) Purdue Vocabulary	.25	.28	-.19	-.05	-.10	X								
7) Nelson-Denny Vocabulary	.28	.35	-.11	-.15	-.12	.85	X							
8) Verbal Reasoning	.32	.16	-.27	-.18	-.07	.57	.60	X						
9) Remote Associates Test	.34	.15	-.05	-.03	.00	.45	.54	.44	X					
10) Word Fluency	.39	.21	-.15	-.06	.07	,25	.33	.41	.33	X				
11) Scrambled letters anagram	.23	.10	-.18	-.02	-.02	.39	.45	.43	.45	.40	X			
12) "Generation" anagram task	.21	.17	-.05	-.01	.24	.31	.38	.38	.34	.60	.44	X		
13) Alternate Uses Test	.23	.33	-.11	-.07	.10	.29	.33	.42	.18	.33	.14	.31	X	
14) ACT (English subtest)	.27	.21	-.31	.06	.06	.64	.63	.75	.38	.48	.42	.43	.48	X

$p<.05 = .25$

$p<.01 = .32$

Table 6

Rotated Factor Matrix: Females

Variables/factors	I	II	III	IV	h^2	Total
Role Category Questionnaire	.18	.34	.26	-.25	.28	
Number of Different Constructs	.17	.10	.35	-.21	.20	
Rep test	-.18	-.06	-.18	-.28	.14	
T-units	-.02	-.06	-.13	.45	.22	
One-syllable words	-.16	.17	.04	.31	.15	
Purdue Vocabulary	.83	.10	.26	-.05	.76	
Nelson-Denny Vocabulary	.84	.21	.26	-.21	.87	
Verbal Reasoning	.56	.29	.56	.03	.60	
Remote Associates Test	.50	.41	.03	-.10	.43	
Word Fluency	.12	.72	.32	.02	.63	
Scrambled letters anagrams	.46	.50	-.02	.06	.46	
"Generation" anagram task	.19	.69	.20	.13	.56	
Alternate Uses Test	.13	.19	.65	.02	.48	
ACT (English subtest)	.61	.27	.55	.35	.87	
% Total Variance	19.40	12.90	10.30	4.90		47.45
% Common Variance	40.88	27.29	21.62	10.19		100.00

Yet, the moderate loadings of the RAT and the Scrambled letters anagram task show that Factor I includes some kinds of verbal fluency. This factors accounted for 19.4% of the total variance and was labeled Verbal Aptitude.

Factor II was defined by Word Fluency (.72) and the "Generation" anagram task (.69) and the Scrambled letters anagram task (.50). Guilford

(1963) has included these measures under the term "word fluency" in his tests of divergent thinking, an ability distinct from that defined by Factor I. However, the RAT (.41) loaded on Factor II as well, indicating that a type of associational fluency or verbal creativity determined this factor in part. Factor II accounted for 12.9% of the total variance and was called Verbal Fluency.

The Alternate Uses Test (.65), the ACT (.55), and Verbal Reasoning (.45) loaded on Factor III. The Alternate Uses Test conforms to Guilford's definition of ideational fluency, or the ability to generate many ideas in a limited time. Verbal Reasoning also makes use of the subject's ability to generate ideas by forming analogies. The high loading of the ACT suggests that there is also some kind of verbal aptitude at work in Factor III. Perhaps the communality in this factor rests on stored verbal information and stored verbal ideas rather than solely on the ability to generate novel uses as indicated by the presence of the Alternate Uses Test. This factor has been termed Ideational Fluency and it accounted for 10.3% of the total variance.

Factor IV was defined by the T-units (.45). This measure was taken from the writing sample (Crockett, 1965) and dealt with the relative length of the sentences in the descriptions. Those subjects using longer sentences demonstrated a more mature (Hunt, 1965), fluent writing style. For this reason Factor IV was called Writing Fluency and accounted for 4.9% of the total variance.

Combined Analysis

Pearson product-moment correlation coefficients among the 14 variables are presented in Table 7. The intercorrelations were subjected to

Table 7

Correlation Matrix: Combined

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1) Role Category Questionnaire	X													
2) Number of Different Constructs	.27	X												
3) Rep Test	-.08	-.08	X											
4) T-units	-.02	-.06	-.06	X										
5) One-syllable words	-.07	-.04	-.05	.24	X									
6) Purdue Vocabulary	.22	.25	-.12	-.11	-.16	X								
7) Nelson-Denny Vocabulary	.26	.32	-.07	-.14	-.17	.82	X							
8) Verbal Reasoning	.35	.23	-.15	-.15	-.14	.63	.67	X						
9) Remote Associates Test	.34	.18	.04	-.03	-.13	.45	.51	.50	X					
10) Word Fluency	.38	.19	-.10	.04	.03	.17	.27	.37	.32	X				
11) Scrambled letters anagrams	.26	.14	-.11	-.03	-.07	.36	.47	.48	.45	.42	X			
12) "Generation" anagram task	.30	.16	.03	-.02	.04	.28	.38	.39	.33	.56	.51	X		
13) Alternate Uses Test	.33	.21	-.13	.00	.02	.21	.28	.34	.22	.34	.17	.31	X	
14) ACT (English subtest)	.37	.25	-.14	.02	.01	.59	.60	.71	.49	.40	.41	.40	.33	X

$p<.05 = .14$

$p<.01 = .20$

a principal components factor analysis and yielded four factors with eigenvalues greater than 1.0. The four factors accounted for 45.7% of the total variance. The factors were rotated by means of a varimax rotation solution. The rotated factor matrix is presented in Table 8.

Factor I was defined by the Purdue vocabulary (.85), the Nelson-Denny vocabulary (.82), Verbal Reasoning (.65), and the ACT (.62). The Remote Associates Test (.44) loaded moderately on Factor I also. Vocabulary seems to be the major component of Factor I, but other verbal skills are also involved. Verbal Reasoning and the ACT are considered measures of general verbal ability and predictors of school success. The moderate loading of the Remote Associates Test suggests that some ability to associate words is included in Factor I. Factor I accounted for 19% of the total variance and was labeled Verbal Aptitude.

Factor II was defined by the "Generation" anagram task (.73), Word Fluency (.63), and the Scrambled letters anagrams (.59). These tasks are all associated with word fluency as measured by Guilford (1963). Factor II was called Word Fluency and accounted for 13% of the total variance.

Factor III was defined by the Role Category Questionnaire (.56) and the Alternate Uses Test (.48) as well as Word Fluency (.38) and the ACT (.39). The Role Category Questionnaire and the Alternate Uses Test are productive measures and involve listing attributes of persons or ways to use common objects. Persons scoring high on these measures are able to generate many ideas in a limited time period. However, the moderate loading of the ACT indicates that general verbal skills are involved in Factor III also. Factor III accounted for 9% of the total variance and

Table 8

Rotated Factor Matrix: Combined

Variables/Factors	I	II	III	IV	h^2	Total
Role Category Questionnaire	.11	.29	.56	-.10	.42	
Number of Different Constructs	.20	.07	.35	.06	.17	
Rep test	-.12	.04	-.19	-.15	.08	
T-units	-.07	.01	.00	.42	.18	
One-syllable words	-.10	.02	-.02	.55	.31	
Purdue Vocabulary	.85	.09	.16	-.13	.77	
Nelson-Denny Vocabulary	.82	.25	.19	-.19	.81	
Verbal Reasoning	.65	.32	.35	-.12	.66	
Remote Associates Test	.44	.38	.21	-.15	.41	
Word Fluency	.07	.63	.38	.09	.55	
Scrambled letters anagrams	.36	.59	.08	-.05	.49	
"Generation" anagram task	.19	.73	.15	.04	.59	
Alternate Uses Test	.14	.22	.48	.06	.30	
ACT (English subtest)	.62	.31	.39	.12	.65	
% Total Variance	19.06	13.07	8.97	4.55		45.65
% Common Variance	41.75	28.63	19.65	9.97		100.00

and was called Ideational Fluency.

Factor IV was defined by the mean number of one-syllable words (.55) and the T-units (.42). Respondents who wrote longer sentences as measured by T-units also used more one-syllable words in their descriptions. Since one-syllable words are often function words, they could have influenced the measure of sentence length used in the study. Persons using longer sentences have been considered to have a more fluent, mature writing style (Hunt, 1965). For this reason Factor IV has been termed Writing Fluency, and it accounted for 4.6% of the total variance.

Similar factor structures were demonstrated for both sexes in the present study. A Verbal Aptitude factor accounted for the majority of the total variance, and Verbal Fluency defined the second factor. An indication of Writing Fluency emerged for both sexes, although it proved to be somewhat weaker for females. Cognitive Differentiation as measured by the Rep test defined a fourth factor for males, whereas Ideational Fluency defined the fourth factor for females. Since the three measures of cognitive complexity were not correlated and did not load on any one factor, it must be concluded that the three methods considered in the present investigation are not interchangeable (Miller, 1967; Leitner, Landfield, & Barr, Note 2).

The findings of the present study pose a serious question to the area of cognitive complexity. Since the measures designed to assess complexity are not highly correlated, can it be said that cognitive complexity exists as an underlying construct? If so, more than one measure ought to be able to estimate it. If complexity is a multi-faceted trait, composed of both differentiation of constructs and a hierarchical struc-

ture integrating the constructs, a valid measure of cognitive complexity needs to be developed which could assess both of these aspects.

Although some relationship between the free description technique of assessing cognitive complexity (Crockett, 1965) and verbal aptitude was demonstrated in this study, the relationship is not a strong one. The moderate loading of the Role Category Questionnaire on the Verbal Aptitude factor shows that this relationship is of some importance for males, but not as important for females. The loading of the Role Category Questionnaire and the Alternate Uses Test on the same factor in the combined analysis indicates that free description is related to some kinds of fluency skills, especially those dealing with the production of ideas. The sex difference on the Rep test calls for replication to ascertain whether sex differences in complexity measures are reliable. Once again, the factor structure of the present study shows that existing cognitive complexity measures are not all estimating the same aspect of personality.

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Footnotes

[1]A syllable was determined by the careful pronunciation and formal style level of the speaker of standard American English doing the scoring. Scoring of syllables was performed by a graduate student in the English department at the University of Nebraska at Omaha.

[2]A few subjects were dropped from some of the measures because they had not understood the directions to the tests and had made responses which could not be scored. Further, a number of ACT scores were not on file with the University of Nebraska at Omaha, since some students are allowed to take the ACT near the end of their first year at the university. There was no systematic dropping of subjects in the study, and the *n*,s for each of the 14 variables are included in Table 1.