An Assessment of the Role Construct Repertory Test

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This paper reports data on the reliability and external validity of the Construct Role Repertory Test (Rep Test). Results show that test scores were moderately internally consistent; scores exhibited significant correlations with other forms of cognitive functioning, including American College Testing scores in science and mathematics. Based on these results, suggestions for future users of the instrument are presented in the context of test modification. Use within physical processing environments, in addition to the usual social environments, is also advocated.

The Role Construct Repertory Test (Rep Test) developed by Kelly (1955) to measure cognitive complexity has been utilized in many research efforts. The Bieri form of the Rep Test (Bieri, Atkins, Briar, Leaman, Miller, & Tripodi, 1966) is employed commonly in studies of clinical judgment (Tripodi & Bieri, 1964); decision and cognitive conflict (Menasco, 1976; Tripodi & Bieri, 1966); leadership style (Larson & Rowland, 1974; Mitchell, 1970); and the generalizability across stimulus domains (Allard & Carlson, 1963; Durand & Lambert, 1976; Peterson, Venkatesan, & Jolibert, 1976). However, little has been reported in these and other studies on the reliability and validity of the different versions of the Rep Test, though it has a history of over 20 years of use in research.

As indicated above, the Rep Test has exhibited generalizability to physical domains. The studies by Allard and Carlson (1963) and Durand and Lambert (1976) both suggest that Bieri's construct can be adequately measured by replacing social roles with physical stimuli. However, it does appear from these and other studies (Richardson & Soucar, 1971; Vannoy, 1965) that the construct "cognitive complexity" is not a unitary one. Different tests of cognitive structure may produce varying results, depending upon the type of decision behavior that is being studied. For instance, Vannoy found a correlation of only .05 between scores from the Rep Test and those from the Sentence Completion Test. The Sentence Completion Test purportedly measures integrative complexity, defined as the extent to which persons use constructs in an ordered or hierarchical manner.

The Rep Test is designed to yield a measure of "cognitive complexity" based on the number of differentiations made in evaluating given role types. The test is presented in grid form with role types as columns and bipolar adjectives as rows. Bieri's (1966) original role types and scales are shown in Table 1 in the order used for this study.

The test is scored by totaling the number of tied-ratings a subject assigns to a given role type. That is, a score of 1 is assigned for every rating that is equal to any of the ratings below it. The

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Table 1
Items Comprising the Role
Construct Repertory Test (Rep Test)

Role Types	Bipolar Adjectives
1. Yourself	1. Interesting-Dull
2. Person you dislike	2. Independent-Dependent
3. Mother	3. Outgoing-Shy
4. Person you would like to help	4. Maladjusted-Adjusted
5. Father	5. Self Absorbed-Interested in others
6. Friend of the same sex	6. Decisive-Indecisive
7. Friend of opposite sex (spouse)	7. Inconsiderate-Considerate
8. Person with whom you feel most uncomfortable	8. Ill humored-Cheerful
9. Boss	9. Irresponsible-Responsible
10. Person difficult to understand	10. Calm-Excitable

minimum score per role type is then 4 (over the 10 bipolar adjectives), while the maximum score per role type is 45. In this case, all 10 ratings are exactly the same. Total cognitive complexity (TCC) scores range from 40 to 450. High scores represent less complexity, since they suggest an inability on the part of the subject to discriminate a role type on the dimensions represented by the adjectives.

Purpose

Two recent studies have reported on reliability and validity characteristics of the Bieri version of the Rep Test. Seaman and Koenig (1974) reported on different methods of scoring the Rep Test, while Schneier (in press) has reported recent data on validity and reliability of the instrument. The purpose of this paper is to investigate more fully the reliability of the Rep Test and to establish further its external validity. Results will be helpful for researchers who are presently utilizing the Rep Test and for those who must select a measure of cognitive complexity from the many available (e.g., Schroder, 1971).

In the present study, component scores of the American College Testing (ACT) program were investigated as a measure of a mental construct that should be associated with cognitive complexity. High correlations would establish external validity of the Rep Test within an environment where certain cognitive abilities are a requisite for success. Quantitative and verbal abilities reflect the necessary processing of some inconsistent information and the processing of stimuli that may pose problems of fine discrimination. The complex structure generally has a greater number of dimensions available upon which to rely in these information processing situations.

Also, a strong association between undergraduates' grade point averages (GPA) and Rep Test scores is reported, since a strong association would reflect differential performance by students who vary on the trait of cognitive complexity. Finally, inference about the effects of subject boredom and fatigue are investigated, as these factors may affect test scores over the 10 role types.

Problem Background

Reliability

Scant reliability data available on the Rep Test suggests that test-retest reliability is not

normatively high. Vannoy (1965) reported a test-retest coefficient of $r = .64$ for a test of equivalency between the original and modified versions. Schneier (in press) reported a similar result for the modified version using a student sample ($r = .54$, $N = 176$). However, the test-retest correlation for a group of 37 managers was much higher ($r = .82$). In both the Vannoy and Schneier studies, administrations occurred a week apart. Menasco (1975) also found a relatively low test-retest nonparametric correlation for a small sample of subjects ($r_s = .53$, $N = 15$). Modified versions of the test involve adjective ordering and scaling of the adjectives. These modifications are discussed subsequently in the method section.

Concurrent Validity

Aspects of internal validity of the instrument were reported by Vannoy (1965), and more recently by Seaman and Koenig (1974) and Schneier (in press). Both later studies report consistent results in terms of convergent validity. However, the former study reports intercorrelations from different scoring methods on the *same* instrument (grid form of the Rep Test), while the latter study utilizes the same measures of complexity as those used by Seaman and Koenig but *different* instruments for each measurement. Schneier's results are encouraging. However, the correlations between cognitive complexity and the other measures were relatively low, though significant ($r = -.19$ for an information measure [Scott, 1962] of complexity and $r = -.23$ for the Fiedler [1967] Least Preferred Co-Worker Scale). These results are consistent with previous research on the comparability of instruments designed to measure cognitive complexity (Vannoy, 1965; Richardson & Soucar, 1971).

Another often cited study is that reported by Tripodi and Bieri (1963) on a form of concurrent validity. The authors compared results obtained from administering two versions of the Rep Test in which (1) the experimenters provided five bi-polar constructs to be used by subjects for their ratings and (2) subjects provided their own bipolar scales. The two versions resulted in a correlation of $r = .50$. A recent study by Kehoe and Reynolds (1977) indirectly provides some more positive evidence about the concurrent validity of the test. These authors were able to predict Rep Test judgments (based on an early form of the test), using an interactive multidimensional scaling routine. The results showed that the perceived dissimilarity between role types is moderately correlated with scores on the Rep Test (mean correlation = .38).

External Validity

Many previous studies have reported on particular aspects of external validity. Some have been cited fairly consistently by later users of the Rep Test. Vannoy (1965), for instance, reported data from a factor analysis of scores on the Rep Test and 19 other measures of cognitive traits. The Rep Test correlated most highly with factors indicative of the acceptance of conflict in processing interpersonal and conceptual information. Complexity was positively related to these factors, indicating that complex persons are prone to experience cognitive conflict. Later experimental work has confirmed this proposition in studies of clinical judgment (Tripodi & Bieri, 1966) and consumer decision making (Menasco, 1976). Of particular note are studies on decision behavior as a function of cognitive complexity. More complex subjects exhibit greater discrimination in judgment (Tripodi & Bieri, 1964) and utilize to a greater extent inconsistent information in making evaluations of others' behavior, while simple subjects rely on the most recent information (Mayo & Crockett, 1964; Tripodi & Bieri, 1966). Other experimental studies on the predictive ability of the Rep Test in various contexts are reviewed by Bieri (1971).

Further, it may be hypothesized that the complex person will exhibit greater aptitude and achievement skills under conditions where infor-

mation environments are uncertain. A greater tolerance for uncertainty and ambiguity on the part of complex persons is well documented (cf. Tripodi & Bieri, 1964, 1965; Vannoy, 1965; Menasco, 1976; Downey & Slocum, 1976). Achievement success under such conditions should be greater for the complex person than for the simple person. Little information exists concerning this expectation. Two studies that have investigated the association between achievement and complexity (Vannoy, 1965; Richardson & Soucar, 1971) have yielded less than encouraging results; correlations have tended to be relatively low. However, the Rep Test as a measure of cognitive complexity was employed only in the Vannoy study; consequently, results between the two studies are not entirely comparable.

Method

The Grid Form of the Rep Test presented by Bieri et al. (1966) with modifications proposed by Vannoy (1965) was utilized in the present research. Following Vannoy, five of the bipolar adjectives were randomly chosen for reversal; and the six scale numbers were replaced by left (L1, L2, L3) and right positions (R1, R2, R3). These modifications were made to reduce possible response biases for one side of the scale or preferences for particular types of numerical scoring.

From undergraduate courses in business administration at The University of Iowa, 79 subjects were obtained. The Rep Test scores from these subjects were obtained in conjunction with a larger experiment for use in the present study. In addition, data on grade point average (GPA) and American College Testing (ACT) component scores were obtained for these subjects. Component scores are in the following categories: mathematics (MATH), social sciences (SOC), natural sciences (SCI), and composite scores (COMP).

The approach reported here on assessment of reliability is an investigation of the "internal" reliability of the instrument via an analysis of variance (ANOVA) procedure suggested by Kerlinger (1964, pp. 432–440). Further, an assessment of subject fatigue is presented; that is, Rep Test scores may be influenced (biased) by responses that become haphazard (decreasing the score total) or systematic (increasing the score total). Possible biases due to subject fatigue or boredom were tested by employing a test of ANOVA for linear and nonlinear trends (Hays, 1963) on the mean tied score ratings (TCC) for the 10 role types.

Results

Reliability

The ANOVA for internal consistency is presented in Table 2. The coefficient of reliability is obtained by first obtaining mean squares of individuals and residuals as estimates of total variance and error variance, respectively (Kerlinger, 1964). Reliability is then assessed by taking the

Table 2
Analysis of Variance for
Total Items

Source	df	Mean Square	F	P
Items	9	95.94	2.15	<.05
Individuals	78	143.32	3.32	<.01
Residual	702	44.52		
Total	789			

$$r_{xx} = 1 - \frac{\text{Error variance}}{\text{Individual variance}} = 1 - \frac{\text{M.S. Error}}{\text{M.S. Individual}} = .69$$

complement of the ratio of error variance to individual variance. Thus, instrument items must produce fairly consistent results over individuals so that error variance is small relative to individual variance. That is, a reliable instrument will yield " . . . 'true' *differences* among individuals." (Kerlinger, 1964, p. 437).

Total Scores

Table 2 presents the ANOVA results for all 10 stimulus objects (role types) presented in the Rep Test. In this case, the total score for each role type was taken as an item measure. The Rep Test produced responses that were only moderately reliable (r_{xx} = .69), although this coefficient was higher than many previously reported test-retest coefficients. The coefficient was also statistically different from zero as evidenced by the F ratio for individuals ($p < .01$).

Item Clusters

Given that level of complexity may vary according to positive or negative affect of the role-type evaluation (Seaman & Koenig, 1974), an ef-

Table 3
Analyses of Variance
Three Items with Positive Affect

Source	df	Mean Square	F	P
Items	2	11.41	–	
Individuals	78	57.76	1.39	N.S.
Residual	156	41.40		
Total	236			
r_{xx} = .28				

Three Items with Negative Affect

Source	df	Mean Square	F	P
Items	2	147.14	4.13	<.05
Individuals	78	138.88	3.78	<.01
Residual	156	35.60		
Total	236			
r_{xx} = .74				

Four Items With Undetermined Affect

Source	df	Mean Square	F	P
Items	3	78.07	1.96	N.S.
Individuals	78	91.21	2.29	<.01
Residual	234	39.78		
Total	315			
r_{xx} = .49				

fort was made to achieve more consistent results by repeating the ANOVA on these two subsets. It was expected that positive or negative affect items alone would produce more consistency across individual responses and greater differences between individuals in terms of complex and simple discriminations.

In Bieri's original instrument, Role Types 1, 6, 7 are associated with strictly positive affect, while Role Types 2, 8, 9 are likely to be negative. The remainder may fall into either category, depending upon the individual making the evaluation. Therefore, analyses of internal reliability were conducted for these three subsets of role-type affect. Results are presented in Table 3.

Items with positive affect did not provide reliable results. Little difference existed in the attributions of complex and simple individuals. Results were more encouraging, however, for the items with negative affect ($r_{xx} = .74$, $p < .01$) and those with undetermined affect ($r_{xx} = .49$, $p < .01$). In fact, the negative items showed a slight improvement in reliability over the pooled items.

For this sample of respondents, it would seem that items with negative affect and those with an undetermined affect were more reliable measures of complexity than the positive items. This interpretation is consistent with results of previous studies (Erwin, Tripodi, & Bieri, 1967; Seaman & Koenig, 1974) that found greater dif-

ferentiations for negatively valued persons vs. positively valued persons.

Order Effects

Analysis of variance was also used to test for trends in mean responses to the 10 role types. Trends in mean responses may surface due to biased individual ratings. Biased responses may result from boredom or fatigue and induce either very low or very high item (role-type) scores. Such responses, if pervasive, should appear as trends over the 10 role-type ratings.

Two ANOVA models were employed. The first model was a test for linear trends and general nonlinear trends (Hays, 1963). Results revealed nonsignificant linear trends between items, but significant nonlinear trends were discovered ($F = 1.98$, $p < .05$). Therefore, an ANOVA for specific nonlinear trends (Table 4) was justified; and results from the first model are not reported, since they are redundant. The method of orthogonal polynomials which was used here (Hays, 1963) was that in which optimal weights are chosen to compute quadratic and cubic sums of squares. Only the nonlinear F ratios for cubic trends were significant. Nonlinear trends of higher order were not significant. An S-shaped curve (indicative of cubic trends) provided the best fit over the 10 means.

Table 4
ANOVA for Tests of Trends

Source	df		Mean Square	F	p
Between	J-1=	9	—		
Linear		1	.04	—	
Quadratic		1	107.52	1.97	N.S.
Cubic		1	475.53	8.74	<.01
Higher Order	J-4=	6	46.56	—	
Error	(J-1)x(N-1)=	780	54.41		
Total					
$\omega^2 = .01$					

Although there appeared to be nonlinear trends in the data, the proportion of variance explained by nonlinear trends was inconsequential. ($\omega^2 - \varrho_{xy}^2 = .01$, where ϱ_{xy}^2 = proportion of variance explained by linear trends, and ω^2 is the total proportion of explained variance. The difference between ω^2 and ϱ_{xy}^2 is the proportion explained by nonlinear variance. Here, $\varrho_{xy}^2 = 0$.) Thus, it is doubtful that any systematic order bias was induced by boredom or fatigue. However, future researchers may wish to randomly alter the order of role-type placement and to repeat the analysis of trends presented above. The cubic trend should disappear if item means are a function of complex or simple attributions rather than a systematic effect of some unknown factor.

Validity

Results of Pearson correlation coefficients between TCC, GPA, and ACT scores are reported in Table 5. Two-tailed tests of significance were used, based on the a priori notion that total cognitive complexity (TCC) may relate inversely to some cognitive abilities but not to others. The correlations reported here were much higher than similar measures reported by Vannoy (1965) for verbal and quantitative ability.

Correlations with ACT scores were based on $N = 74$, because of missing data for five subjects. GPAs were obtained for the full sample. All correlations were negative, indicating a positive relation with complexity. (Lower Rep Test scores represent greater cognitive complexity.) These correlations were significant, with the exception of the social science (SOC) component of ACT. This suggests that complex persons possess cognitive abilities that are exhibited *primarily* in quantitative aptitudes. Conceptually, complex persons may handle abstract information more efficiently than simple cognizers. The Rep Test seems to reflect this requirement, whereas social science skills may require abilities that are less abstract in nature.

These results are consistent with data reported by Vannoy. His factor analysis of Rep Test scores and other personality measures, to include quantitative and verbal abilities, revealed high loadings on the Rep Test (−.47) and the quantitative measure (.33) for Factor II. These loadings suggest that complexity and quantitative ability vary together in relation to Factor II. In addition, criticalness and a measure of perceptions of conceptual distance among objects were highly related to Factor II (.62 and .70, respectively). Rep Test scores did not load high on Factor I, while verbal abilities loaded .64. Vannoy's verbal and quantitative measures were taken from the Cooperative School and College Ability Test.

The significant correlation between TCC and GPA ($r = .25$) reflects the earlier discussion on cognitive complexity and achievement. Those persons who have developed more abstract cognitive processes meet with greater academic success.

Table 5
Correlations of Rep Test Scores
With Component Measures of ACT and GPA

Rep Test	ACT				SCHOLASTIC ACHIEVEMENT
TCC	MATH	SOC	SCI	COMP	GPA
r	−.33	−.19	−.42	−.33	−.25
N	74	74	74	74	79
p	<.005	<.13	<.001	<.005	<.05

Discussion

Bieri's original version of the Rep Test appears to yield only moderate reliability over the 10 items, although positive and negative role-type affect resulted in differential reliability coefficients. This is, however, consistent with results from previous studies.

Future users of the Rep Test should take into consideration the moderate reliability of the instrument. One way to increase reliability is to utilize a modified format in which only role types of negative affect are included. Evaluations of negative role types appear to be more consistent than evaluations of positive ones.

It is doubtful that any systematic bias is induced by fatigue or ordering of the items. Although significant cubic trends were found over the 10 items, the proportion of explained variance due to nonlinear trends was near zero. It was concluded that response bias from boredom or fatigue should not be a significant concern in administering the test.

Correlates of cognitive complexity were presented in the context of construct validation. Little has been previously reported in the literature on complexity and other types of cognitive abilities as measured by the Rep Test. Results supportive of Vannoy's factor analysis suggest that cognitive complexity is related more to quantitative and scientific skills than to verbal skills. An ability to discriminate among abstract stimuli in a mathematical sense may be reflected in the correlations between Rep Test scores and the ACT scores. This result is a partial confirmation of previous research suggesting that the Rep Test is an adequate discriminator of complex and simple behavior within *physical* domains, in addition to *social* ones (Allard & Carlson, 1963; Meansco, 1975; Durand & Lambert, 1976). Thus, the instrument should be applicable to a wide variety of information-processing situations.

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