Technical Research Note 203

# FACTORIALLY DERIVED INFORMATION MEASURES FOR DIFFERENTIAL PREDICTION OF OFFICER PERFORMANCE

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BEHAVIORAL EVALUATION RESEARCH DIVISION



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U. S. Army Behavioral Science Research Laboratory

# December 1968

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# FACTORIALLY DERIVED INFORMATION MEASURES FOR DIFFERENTIAL PREDICTION OF OFFICER PERFORMANCE

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## U. S. ARMY BEHAVIORAL SCIENCE RESEARCH LABORATORY

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# BEHAVIORAL SCIENCE RESEARCH LABORATORY

An activity of the Chief, Research and Development

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### FOREWORD

The mission of the OFFICER PREDICTION Work Unit is to develop improved eans of assigning officers who have aptitudes and other characteristics to meet the differing demands of different officer activities.

The research program consists of the development of psychological tests and techniques and the evaluation of the measures as differential predictors of performance in combat, technical, and administrative duties. In 1958 and again in 1962, experimental tests for the Differencial Official Battery were officialistered to Regular Army and Reserve officers entering on active duty, numbering more than 10,000. The experimental predictors are being evaluated as predictors of success as measured by several methods. Ratings by superiors and peers were accomplished after about one year of active duty. In 1964 1965, a series of situational tests in which the officer is confronted with problems typical of service under combat conditions in each of the three areas was administered to 900 officers previously tested with the experimental battery. The exercise was staged at the Officer Evaluation Center established for the purpose at Fort McClellan, Alabama. In 1967 and 1968, evaluations of performance in combat (Vietnam) and in combat-ready situations (Europe, Korea, CONUS) were obtained.

Analyses now being completed are concerned on ofly with means of scoring the predictor instruments. The present Technical Research Note details the analysis of officer responses and formulation of scoring scales for the information tests of the battery.

The entire research work unit is responsive to special requirements of the Deputy Chief of Staff for Personnel as well as to requirements of RDT&E Project 2J062106A722, "Selection and Behavioral Evaluation: Personnel Measurement," FY 1969 Work Program.

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J. E. UHLANER, Director U. S. Army Behavioral Science

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# FACTORIALLY DERIVED INFORMATION MEASURES FOR DIFFERENTIAL PREDICTION OF OFFICER PERFORMANCE

### BRIEF

#### Requirences:

Development of scoring formulas for many of the experimental predictors of the Differential Officer Battery requires detailed and complex analysis of officer responses. These analyses, while time-consuming, are an essential step toward the end product-psychological measures that are usefully discriminative for assignment of officers to combat, technical, and administrative duties.

#### Procedure:

Analysis of the information test in the battery took the unusual form of a double analysis-reach analysis based on half the questions--and a synthesis of the results. Two equivalent sets of questions were formed from the 600 information questions in the battery. The officer sample for both analyses consisted of 900 officers who took the test at entry on active duty, 100 being randomly selected from each of nine branches of service. In each analysis, officer responses were grouped on the basis of interrelationships (factor-analyzed) to define relatively independent areas of information. Matching areas defined in the two parallel studies were identified for scoring purposes. Questions not belonging in the matched areas were assembled on the basis of content into 13 additional sets.

#### **Findings:**

Ten areas of information were matched in the two separate analyses:

Practical skills Technology operations Math - physical science History - politics Literature - arts Entertainment - culture Finance Organized sports Intellectual games Biochemistry

#### Utilization of Findings:

All 23 scores formulated as a result of the analyses will be evaluated as predictors of officer performance as determined by 1) ratings after one year of active duty, 2) performance in a simulated combat exercise conducted at the Officer Evaluation Center, and 3) 1967-68 ratings obtained in the field, either in combat in Vietnam or in combat-ready situations (Europe, Korea, CONUS). The studies will demonstrate to what extent scores on the several information areas are differentially predictive of officer effectiveness in combat, technical, and administrative assignments. Basing scores on a double analysis should reduce the effect of chance results in evaluating the prediction achieved.

# FACTORIALLY DERIVED INFORMATION MEASURES FOR DIFFERENTIAL PREDICTION OF OFFICER PERFORMANCE

# CONTENTS

.

	Page
BACKGROUND	1
Design of Overall Study	1
OBJECTIVES	1
METHOD	2
Sample for Analysis Variables Analysis Procedure	
RESULTS	4
Identification of Factors Matching Odd and Even Factors Correlation among Factor Scales Independence among Factor Scales Selection of Items for Final Scoring Scales	4 5 3 11
SUMMARY	1 * 2
DISTRIBUTION	10
DD Form 1473 (Document Control Data - B&D)	1 2

ABELS			i sigr
Table	1.	Content categories represented in DOB information tests	Z,
	2.	Percent of total variance accounted for by 17 factors in each sample	4
	3.	Content categories represented in DOB information factors	6
	4.	Percentages of items from content categories included in matched factors from odd- and even-item data	7
	5.	Correlation between matched odd-even factor scales	
	б.	Correlations among factor scales (odd-even averaged)	Ċ,
	7.	Correlations between factor scales (odd-even averaged) and residual content scales	Ĵ.Э
	૪.	Ten final factor scales	1.
	Ģ,	Estimated reliabilities and intercorrelations among final factor scales	17
	10.	Final residual content scales	14

# TABLES

1

.

-----

Page

4

6

7

# FACTORIALLY DERIVED INFORMATION MEASURES FOR DIFFERENTIAL PREDICTION OF OFFICER PERFORMANCE

#### BACKGROUND

The research reported here is part of a comprehensive longitudinal program to predict officer performance by psychological measures obtained at entry on active duty. In 1957 and again in 1.02, large samples of officers took an extensive battery of measures of officer leadership potential. These measures were designed to evaluate qualities important in military leadership in any area--the "generalist" concept--and qualities relevant to performance in each of three broad areas--combat, technical, and administrative. The  $1 e^{-1}$  input of  $4^{-1}$  officers, from which the present sample was drawn, took a two-day battery of measures called the Differential Officer Battery DOB' at the beginning of attendance at Branch Basic Officer courses. About one year later, their job performance and potential were evaluated by supervisors and colleagues working closely with them. Some six months later, officers in a selected sample were evaluated in a three-day integrated exercise simulating performance of combat, technical, and odministrative duties in a combat situation staged at the Officer Evaluation Center specially instituted for the evaluations. Finally, in the period from Spring 1007 to Spring 1007. those members of the original 4% -man sample who were still on active duty were rated on job performance in a combat theater. Vietnam) or in combat-ready signations in Europe, Korea, or CONUS.

#### Design of Overall Study

The basic design for the comprehensive study consists of 1° analysis of the predictor battery to yield scores that are relatively homogeneous and independent. I validation of these scores as predictors of three measures of officer effectiveness-first-year ratings, performance in a simulated combat situation, and final 10% - cratings, and f criterion comparison and equivalence analyses. The present report covers the first step in analysis of the predictor battery--internal analysis of the information tests to define the scores to be obtained.

#### OBJECTIVES.

The primary objective was to obtain relatively homogeneous item clusters for assembling into scales to be validated for all criteria. In addition, the comprehensive data afforded an portunity for an empirical test of the usefulness of factor analysis of item intercorrelations as a technicul for developing homogeneous scoring scales. Since the information measures contained to multiple-choice items covering of different content areas, it was practicable to divide the analysis into two equivalent parts with 300 items in each. In this way, the factors and scales obtained from the two analyses could be compared and the stability of factor structure across the two analyses could be assessed. Thus, a second objective was to assess the ertent of factor congruence in two samples of item content.

#### METHOD

#### Sample for Analysis

The analysis was designed to reveal psychological factors across all branches of service. Therefore, the sample was selected to afford adequate representation of all branches rather than the proportions found in the input population. There were nine branch basic courses: Infantry, Armor, Artillery, Engineer, Signal, Ordnance, Quartermaster, Adjutant General, and Finance. From each of these, 100 cases were randomly selected to compose the analysis sample of 900. In general, the first three could be considered to represent combat, the next three technical, and the last three administrative specialties.

#### Variables

The DOB contained four information tests of 150 items each. The 300 odd-numbered items constituted the set of variables for one analysis, the even-numbered items the set for the other analysis. The number of items in each set belonging to each content category is shown in Table 1.

#### Analysis Procedure

Steps in the analysis were as follows:

1. Correct response p-values were obtained for all items. Those with extreme values-less than .10 or greater than .90--were excluded from further analysis.

2. All retained items were intercorrelated (tetrachoric r). There were 290 items in each matrix.

5. Each matrix was factored by the principal axes method, using the highest off-diagonal entry as the communality estimate.

4. After inspection of the eigen values, the first 17 factors were rotated to simple structure by the varimax method.

5. Factor clusters were assembled, each item being placed in the cluster for which it showed the highest loading.

6. The clusters were refined to provide scales of 20 items where possible. Items with higher loadings in a given factor and negligible loadings on all other factors were given preference in set ction for a scale.

- 2 -

Table	1
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### CONTENT CATEGORIES REPRESENTED IN DOB INFORMATION TESTS

	N	lumber of Ite	ms
Category	Odd	Even	Total
Combat Tactics	25	25	50
Organized Sports	1-5	14	29
Nature Sports	7	8	15
Farm Facts	\$ <u>}</u>	9	18
Biology-Medicine	10	9	19
Psychology-Psychiatry	9	10	19
Technical Service Hardware	25	25	50
Mechanical Information	13	12	25
Fhysics	8	9	17
Chemistry	8	8	16
History and Philosophy of Science	8	7	15
Mathematics	13	14	27
Supply, Warehousing	25	25	50
Games	8	8	16
Art	9	9	18
Music	8	8	16
Entertainment	9	9	18
Literature	16	16	32
Finance	28	27	55
World Affairs, Politics	15	16	31
Socioeconomic Facts	11	11	22
Quantitative Miscellany	8	8	16
Qualitative Miscellany	13	13	26

- 3 -

#### RESULTS

#### Identification of Factors

The proportions of total variance included in each of the 17 rotated factors in each analysis are shown in Table 2. It will be remembered that the analysis was based on it can intercorrelations, which tend to be moderate in size because of modest single-item reliability. Not every factor provided enough items with highest loadings to yield a usable scale.<sup>1</sup> Furthermore, clusters of items were identified in which there were substantial loadings on two factors. Even though such clusters could not provide relatively independent scales, they promised reasonable homogeneity, and the segregation of their items from the clusters with unique loadings on one or the other of the two factors improved the homogeneity of scales based on the unique clusters. The result was the identification of 14 usable factor scales in each analysis. Analysis of the odd-numbered items yielded 13 reasonably unique one-factor scales and one scale of items loaded on factors I and IV. Analysis of even-numbered items yielded 12 one-factor scales plus factor I-IV and factor II-V combinations.

#### Table 2

	Percent of	Variance
Factor	Odd	Even
I	3.66	4.25
II	2.46	2.97
III	2.72	2.65
IV	4.55	2.75
V	1.60	1,86
VI	1.98	1.77
VII	1.49	0.97
VIII	0.91	1.00
IX	1.01	1.05
Х	0.90	0.96
XI	0.84	0.92
XII	0.85	0.85
XIII	0.93	0.88
XIV	0.85	0.87
XV	1.65	0.84
XVI	0.91	0.82
XVII	0.91	0.81
Total	28.22	26.32

#### PERCENT OF TOTAL VARIANCE ACCOUNTED FOR BY 17 FACTORS IN EACH SAMPLE

Factor VII in the odd set had only 5 items, factor VII in the even set only 3. These factors were retained because of the very high loadings (odd, .64 to .77; even, .71 to .^3).

- 4 -

#### Matching Odd and Even Factors

Factors derived from analysis of the odd- and of the even-numbered information items were compared on the basis of number of items from each content category. Table 5 presents the tabulation of number of items in each content category for the matched factors. Thus, odd factor I (I<sub>0</sub>) has 20 items across six categories, and matched even factor IV (IV<sub>e</sub>) has 20 items across five of these same categories. It was clearly revealed that odd factor I matched even factor IV, that odd factor IV matched even factor I, and that the I-IV combination factors were matched. In addition, factors II, III, and V through VIII matched their respective number. in the other set, and odd factor XV matched the even II-V combination. Partial matching was achieved between odd XIV and even IX, and between odd XIII and even XIV. Only two factors from each set failed to match by this comparison.

Table 4 shows the percentage of items from each content category in the matched factors and affords a ready basis for interpretation of the factor scales. The table also suggests to some extent the content relationships among factors I and IV and the combination scale, and among factors II and V and the combination scale. The latter scale emerged as a separate factor XV in the odd set. The broad interpretations of the scales are as follows:

Uaa	Even	
I	IV	Practical bnowledge, rural-mechanical
I-IV	1-IV	Mechanical and physical science knowledge
IV	1	Physical sciences and mathematics
II	II	Humanities, social science
XV	II-V	Entertainment, arts
V	V	Aesthetics
III	III	Finance
VI	VI	Organized sports
VII	VII	Intellectual games
VIII	VIII	Biology, chemistry
XIV	IX	Military tactics, technical services
XIII	XIV	Supply

- 5 -

CONTENT CATEGORIES REPRESENTED IN DOB INFORMATION FACTORS

	Factors		Fact	57.8		Facto	or s
Category	I <sub>O</sub> IV <sub>E</sub>	Category	1- IV <sub>О</sub>	I-IV <sub>E</sub>	Category	IV <sub>0</sub>	IE
Nature Sports Farm Facts Biology-Medicine Tech Svc Hardware Mech Information Other	44 1- MOO 01 11 10 MOO 44 10 00	Farm Facts Tech Svc Hardware Mech Information Physics Chemistry Other	0500074	0000000	Tactics Tech Svc Hardware Physics Chemistry Mathematics Other	ユー <b>キ</b> ょ 00	a a troc
Art Music Entertainment Literature Politics Socioeconomic Other	II 0 0000040 1 0 0001040	Finance Other	0111 5 5	111 130 130 130	Psycho-Psychiat Tech Svc Hardware Art Music Literature Finance Socieconomic Other	> OH4MQHUM	<mark>&gt;</mark> 00040014
Organized Sport Other	VIO VIE 12 11 5 5	Games Other	0 5 0	VIIE	v Biology-Medicine Chemistry Politics Other	VIII0 4 1 5 2	VIIIE 33 18 19 19 19 19 19 19 19 19 19 10 10 10 10 10 10 10 10 10 10 10 10 10
Supply and Whsg Politics Other	XIII <sub>O</sub> XIVE	Tactics Tech Svc Hardware Supply and Whsg Games Other	۸IV 4 ۹ ۵ ۵ ۵ ۹ 4 4	<b>E</b> ההההש <mark>ב</mark>	Hist & Phil of Scier.ce Music Entertainment Literature Other	e XV 6 4 4 6 6 7	11-VE NGUNUE
	Category Psychology-Ps Technical Ser Mechani al In History and P Supply and Wa Finance Other	ychiatry vice Hardware formation hilosophy of Science rehousing	un overer4	uatched TILE Norocho	Factorst XVIIO XVIIO NDDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDDD NDDDD NDDDD NDDDD NDDD NDDDD NDDDD NDDDD NDD NDDD NDDD NDDDD NDDD NDDDD NDDDD NDDDD NDDDD NDDDD NDDDDD NDDDDD NDDDDDD		

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Total of 2 or more items across all four factors.

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Table 3

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### Table 4

### PERCENTAGES OF ITEMS FROM CONTENT CATEGORIES INCLUDED IN MATCHED FACTORS FROM ODD- AND EVEN-ITEM DATA

Content Categories	Odd Factor	Ev	en Fact	ors
Nature sports, farm facts Tech svc hardware, mech information	I 55 <sup>°</sup> 35	1V <u>40</u> <u>50</u>	<b>I-IV</b> 10 35	I 0 10
Tech svc hardware, mech information Physics, Chemistry	1-1V 55 25	50 0	<u>35</u> 15	10 35
Physics, Chemistry Mathematics	IV <u>40</u> <u>50</u>	0 0	15 0	<u>35</u> <u>45</u>
Art, Literature Politics, Socioeconomic	11 <u>35</u> 50	11 15 45	V 40 5	11-V 25 0
Art, Music Literature	v <u>35</u> <u>30</u>	25 5	20 25	17 25
Music, Entertainment Literature	xv 55 10	25 5	10 25	<u>42</u> 25
Finance	111 <u>85</u> VI	111 <u>90</u> VI		
Organized Sport	<u>100</u>	<u>100</u>		
Game s	<u>100</u>	<u>100</u>		
Biology-Med, Chemistry	VIII <u>62</u>	<b>VIII</b> <u>70</u>		
Tactics, Tech svc hardware	<b>XIV</b> <u>60</u>	<b>IX</b> <u>60</u>		
Supply and Warehousing	XIII <u>45</u>	x i v <u>50</u>		

<sup>8</sup>Underlined values (percentages) are for matched factors.

#### Correlation among Factor Scales

A more precise test of whether the same factors are found in the two analyses is of course the correlation between matched factors based on subjects' scores on the two scales. The correlation coefficients, providing estimates c reliability, are shown in Table 5. These coefficients between independently determined scales would be expected to be lower than reliability estimates based on odd-even assemblies in a consecutive

- 7 -

sequence. To provide comparable estimates, the reliabilit, per unit length (that is, for a single item) is presented, as well as the reliability estimate for the combined pair of scales. It is evident that most correlation coefficients for the combined scales are in the acceptable range of reliability for tests of the given length.

#### Table 5

Odd	No. of	Even	No. of	Correlation	Reliabilı	ty
Factor	Items	Factor	Items	Coefficients*	Single Item	Scale <sup>a</sup>
I	20	IV	20	660	088	79
I 7	20	I-IV	15	757	151	86
IV	20	I	20	795	162	89
II	20	11	20	668	091	80
v	20	v	20	506	0 <b>4</b> 9	67
XV	20	II-V	12	477	054	66
III	20	111	20	782 152		82
VI	12	VI	11	624 126		76
VII	5	VII	3	624         126           215         064		37
VIII	8	VIII	<b>1</b> 0	<b>4</b> 26	5 064 6 074	
XIV	10	IX	15	282	030	44
XIII	12	XIV	8	152	018	26
	м	atched Od	d-Even R	esidual Content	Scales	
Tactics	15	Tactics	15	196	016	33
Supply	15	Supply	14	<u>333</u>	033	50

#### CORRELATION BETWEEN MATCHED ODD-EVEN FACTOR SCALES

<sup>8</sup>Decimal points omitted.

All items not included in the factor scales were assembled into residual content scales, all items from one content category being placed in a single scale. There were enough residual items in two categories--Tactics and Supply-to provide both odd and even scales. Correlation within these pairs is shown for comparison with correlation between matched factor scales. It is evident that the unit reliability coefficients for these residual content scales are equivalent to those for the partially matched factor scales--the last two listed. From the data in Table 5, the decision was made to use the first ten factor scales for scoring and to relegate the items of the last two to residual content scales, obtaining in all 17 scales. Hereafter, factors XIV, IX, XIII, and XIV, are treated as unmatched factors.

#### Independence among Factor Scales

Table 6 presents the estimated correlation among the ten accepted scales from each analysis, obtained by averaging the correlation coefficients of each pair member with a given pair. (Note that these are not estimates of correlation among the full-length combined scales.) Except for the expected correlation between the scales based on items with loadings on two factors--the I-IV and II-V scales--only the factor VIII scales show appreciable correlation with others--the I-IV set and factor scale II. Correlation with the unmatched factors was also low, except for XIV and IX, which correlated moderately with the same four scales as factor VIII.

Table 7 presents correlation coefficients between the ten selected scales and all residual content scales. All but a few of the moderatesize coefficients are found between content scales and factor scales with five or more items from the same content category.

#### Table 6

#### CORRELATIONS<sup>4</sup> AMONG FACTOR SCALES (ODD-EVEN AVERAGED)

					Fac	ctor Se	cales				
Odd	Even	Odd - I Even - Iv	1 - IV I - IV	IV I	II II	XV II-V	V V	111 111	VI VI	VII VII	VIII VIII
Match	ed Fact	ors									
I	IV	66									
I-IV	I-IV	<u>58</u>	76								
IV	I	28	61	-80							
II	II	16	59	27	67						
XV	II-V	13	21	18	<u>50</u>	48					
v	V	11	13	0.5	18	32	51				
111	III	-01	-00	-09	07	<u>05</u>	12	78			
VI	VI	-05	-11	08	21	23	124	08	62		
VII	VII	1 ~	10	21	16	16	13	06	17		
VIII	VIII	21	40	· · · ·	X,)	(A)	<u>]</u> ٦	<del>-</del> ः)4	04	16	43
Unmat	ched Fa	ctors									
XIV			. ус.	23	$\infty$	25	્રસ્ટ	07	,15	1 3	18
	IX	जुर्द	45	37	25	15	06	07	07	24	27
XIII		11		03	07	ാദ	10	24	$\alpha_{I}$	02	15
	XIV	13		04	11	10	1)	1.	15	02	00
IX		1-	15	$O_{12}^{(2)}$	$e^{\frac{1}{2}}$	1.5	1.1	1*	3.0	m a	$\langle i \rangle$
	XIII	21	24	18	10	17	-01	(Jr)	$(\lambda)^{1/2}$	10	13
XVII		$1_{i}$	17	17	nĝ	Q.4	17	્દ	្រភ	17	$\Sigma_{i}^{2}$
	Х	07	13	11	10	17	17	15	(23	> 6	2.2

\*Decimal points on-itted

<sup>b</sup> Scales based on items with loadings on two factors (e.g., I-IV, II-V) may be expected to correlate subarantially with scales based on items with loadings uniquely on one of the two factors. Underlined coefficients are for such relation-

ships.

				Fa	ctor S	Scal	es <sup>b</sup>			
Residual Content Scales	Odd - I Even - IV	I-IV I-IV	IV I	11 11	XV II-V	v v	III III	VI VI	VII VII	VIII VIII
Tactics (0)	27	27	21	50	03	<u>ار:</u>	0,3	03	13	12
Tactics (E)	-	18	12	10	04	0)	30	<u>`4</u>	12	10
Life Science	25	33	55	15	17	13	00	01	69	<u>06</u>
Psychology	16	15	10	21	16	23	-72	ોર્સ	10	16
Technical Service	<u>45</u>	50	31	13	14	16	-04	-07	11	<u>.</u> `5
Matnematics-Physics	20	30	<u>52</u>	17	14	12	96		14	2×
History and Philosophy of Science	18	27	28	16	17	15	<b>-</b> .`:`	N/	11	1+
Games	65	06	00	<u>ر</u> ،ي	ି4	07	NE	))	<u></u>	ി4
Supply (0)	27	22	12	00	10	1.2		A.1	્રાઈ	s julij
Supply (E)	05	24	13	( د	11	20	: N N	=_`t`	1:1	11
Art-Music-Entertainment	10	20	11	<u> 1</u>	×	<u>.</u>	10	1.1	11	14
Literature	24		וי.	<del>م ،</del>	<b>R</b> 45	<u></u>	:	17	11	Ţ, j
Finance	24	13	.50	14	11	];	4	.) <b>.</b> '	1.1	s <u>i</u>
Politics	्य	1.2	10	2 <sub>6</sub> ·		1 :	<u>!</u> ··	1]		11
Socioeconomic	<b>1</b> 2.4	1	. 1	<u>,1</u>	<u>1</u> .,	14	27	<u>`4</u>	14 <b>2</b>	<u>]</u>
Quantitative Miscellany		1.1	1,	1)	1.	1 :	• • •	1.	54°	14
Qualitative Miscellany	1.2	10	.`}	1		1,1	Ţź	11	24	

Table 7

COLRELATIONS<sup>4</sup> BETWEEN FACTOR SCALES (ODD-EVEN AVERAGED) AND RESIDUAL CONTENT SCALES

<sup>a</sup>Decimal points omitted.

Underlined values are correlations between content scales and factive scales drawing 5 or more items from given content.

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#### Selection of Items for Final Scoring Scales

Based on the above findings, it was decided to assemble ten factorbased scales by combining matched odd-even scales. To provide greater length for five of the scales, item factor loadings and specific content were reviewed, and seven scales of 40 items, two scales of 25 items, and one scale of 10 items were assembled. The resultant scales are listed in Table 8.

The short Intellectual Games scale offers a note of interest. All five items from odd factor VII were about chess, while all three from even factor VII were about bridge. This accidental segregation led to low loadings on factor VII for the one odd item on bridge and the one even item on chess. Adding these two items to the combined scale may well have yielded a more reliable total scale score than would be expected from the coefficient of .22 between the two short factor VII scales.

Table  $\Im$  gives estimated reliability and intercorrelation of the final factor-based scales. Despite particular findings such as that on the Games scale, these estimates are based on the assumption that the unit reliability coefficients and intercorrelations for all scales would be the same as those shown in Tables 5 and  $\hat{e}$ .

Finally, Table 10 shows the selected residual content scales. Where there were too few items left in a given category, items in that category were combined with those of a category to which they appeared to be related on the basis of overall factor results and logic.

Table

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TEN FINAL FACTOR SCALES

Factor Scales	Derivation	No. of Lems	Range of Loadings	Reallocati	on of Items Deleted
Prevical Skills	1 <sub>0</sub> , 1 <sup>v</sup> E	~		8	3 9 9
Technology Operations	1 - 17 <sub>0E</sub>	- <u>-</u>	ж. т Т Т	5 Technical Service	1
Math-Physical Science	17 <sub>6</sub> , 1 <sub>E</sub>	۰ŕ		. Math	l Math
History-Politics	II 0E	<b>N</b> 7	2 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	1 1 1	1 1 1
Literature-Arts	Y <sub>OK</sub>	-,*	• • •	l ea-Psychology, Art, Philosophy	<pre>1 ea-Technical, Finance, Quantitative Misc.</pre>
Entertainment-fulture	XV <sub>C</sub> , II-7 <sub>0E</sub>	м.,		<pre>[ Iterature ] ea-Philosophy, Putertain, Politics, Qualitative Misc.</pre>	l Tactics
Finance	111 <sub>0E</sub>	• <u>.</u> .	· · ·	Finance	l Sociuecunomic
Organized Sports	¥1 QE		• • • • • • • • • • • •	2 Organized Sports	1
Intellectual Games	V.1 1 (JE			Games	1
Blochemistry	чш.			<pre>Biology-Medicine l ea-Tactics, Physics, Politics, Socio- economic, Qual. Misc.</pre>	
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### ESTIMATED RELIABILITIES AND INTERCORRELATIONS AMONG FINAL FACTOR SCALES<sup>4</sup>

Final Factor Scales										
	PS			<u> </u>						
Practical Skills (PS)	30	<b>T</b> 6								
	. <b>.</b>	<u>10</u>								
Technology Operations (TO)	6.5	14	MP							
Math and Physical Science (MP)	33	t P								
				HP						
History, Politics-Culture HP)	1)	74	71	сî?	τA					
Literature and $Arts + LA^{N}$	٦4	٦.	10	÷χ	20					
	• •	-	10	-	•	EC				
Entertainment-Culture (EC)	e <sup>st</sup> e	. 77		5	4		-			
	. 1	1.	• 、		7.4		FN			
Finance E.	- '1	- 1	- 1.,`		14			05		
Organized Sports OS <sup>A</sup>	-1`	-14	20	.`••	1	3]	1 `			
									IG	
intellectual Games (IG)	1	•••	2.1	• •	•				4.)	RC
Biochemistry $BC^{N}$	4		÷.	4.		- 1	<b>_</b> `•.	`.	<b>.</b>	<u>ec</u>
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		Items		
Scale	Content	Number	Total	
Warfare	Tactics	43	43	
Outdoors	Organized Sports	3		
	Nature Sports	4	12	
	Farm Facts	5		
Life Science	Biomedical	4	<b>7</b> ()	
	Psychology	12	16	
Technology	Technical Service	27	70	
	Mechanical Information	5	32	
Math-Science	Physics	3		
	Chemistry	ĺ	11	
	Mathematics	7		
History-Literature	History and Philosophy of Science	7	10	
,	Literature	5	12	
Supply	Supply	44	44	
Intell. Entertainment	Games	6		
	Art	5	177	
	Music	3	Τí	
	Entertainment	3		
Finance	Finance	16	16	
Political Science	Politics	12	12	
Economic-Social	Socioeconomic	13	13	
Quantitative Misc.	Quantitative Miscellany	14	14	
Qualitative Misc.	Qualitative Miscellany	18	18	
	Total		260	

## FINAL RESIDUAL CONTENT SCALES

- 14 -

#### SUMMARY

To obtain relatively homogeneous and mutually independent scales for scoring the 600 items of the Differential Officer Battery information tests, two factor analyses, one using odd items, the other even, were performed on matrices of item intercorrelations. Seventeen principal axes factors in each analysis were rotated to simple structure by the varimax method. From each 17, 14 usable factor-based scales were derived. Matching of these scales by content categories of the items included and by scale intercorrelations demonstrated that the scales from each analysis matched well with scales from the other analysis. The paired scales were then assembled and some were augmented slightly to yield ten final factorbased scales embracing a total of 340 items. The remaining 260 items were assembled into 13 residual content scales.

Factor solutions based on the two samplings of related items showed high congruence in major dimensions. The ten factor scales were tentatively interpreted. All 23 final scales--10 factor and 13 residual content scales--are to be validated for officer performance criteria to determine whether they are differentially predictive of effectiveness in combat, technical, and administrative activities.

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<sup>13. ADSTRACT</sup> Technical Research Note 203 r of a comprehensive longitudinal program nical, and administrative duties by psy duty. In 1958 and again in 1962, an ext	reports on *resea n to predict of vchological meas consive battery	earch completed in the initial p ficer performance in combat, te sures obtained at entry on action of measures of officer leaders	hase ch-
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*Differential Officer Battery (DOB)	ļ					
Dilferential prediction of officer performance						
*Factor analysis						
*Predictor measures						
Psychometrics						
Performance evaluation-combat						
Esychological tests and techniques						
Military leadership-measures of						
*Equivalence analyses						Ì
Development of scoring scales						
*Factor structure-assessment				1		
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