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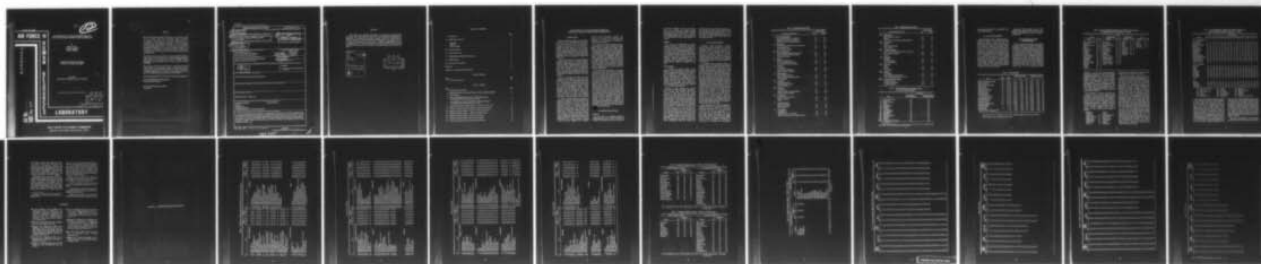
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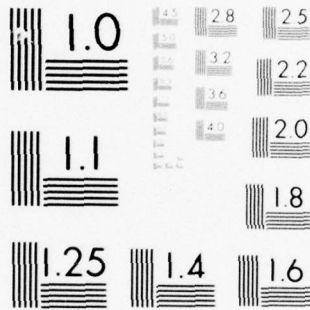
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HUMAN RESOURCES

**DEVELOPMENT OF FACTOR-REFERENCED SUBSCALES
FOR THE VOCATIONAL INTEREST-CAREER EXAMINATION**

By

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Brooks Air Force Base, Texas 78235

June 1977
Interim Report for Period January 1975 - January 1976

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This interim report was submitted by Personnel Research Division, under project 7719, with HQ Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base, Texas 78235. Mr. William E. Alley, Demographic and Attitudinal Research Branch, was the principal investigator.

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PREFACE

This research was conducted under Project 7719, Selection and Classification Technology, task 771909, Specialized Procedures to Improve Personnel Classification and Assignment. The investigation was made in response to RPR 74-24, Development of Improved Techniques for Estimating Person-Job Compatability. The authors would like to express their appreciation to Major Wayne S. Sellman (AFMPC/DPMYR) for his continuing support as requirements manager for the project and to Mr. Charles Greenway (AFHRL/SM) and his staff for the excellent computational support they provided to the effort.

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DEVELOPMENT OF FACTOR-REFERENCED SUBSCALES FOR THE VOCATIONAL INTEREST-CAREER EXAMINATION

I. INTRODUCTION

Without considerable experience in the civilian labor market, it is often difficult for prospective Air Force enlistees to select the most appropriate vocational or technical career. The process of matching the right person with the right job requires careful consideration of the recruit's interests and abilities in relation to the wide range of jobs typically available at the entry level. This is particularly true in view of the fact that initial assignment contracts are binding for a minimum of 4 to 6 years.

Some of the uncertainty in these decisions is reduced through the use of systematic aptitude assessment which delimits those jobs for which the recruit is mentally qualified. Moreover, the needs of the service may further restrict job availability. Once these constraints are met, however, the recruit may still have considerable latitude to choose among several competing occupations without first-hand knowledge of the jobs or the duties involved.

Given the informality with which vocational preferences are considered in the current job-placement system, it is understandable that each year a large number of recruits enter career fields that are inconsistent with their personal interests. The resulting dissatisfaction leads a certain proportion of these people to retrain into other specialties while those obligated to remain in dissatisfying careers are more likely to separate from service prematurely. In either case, additional personnel costs associated with recruiting, processing, and training replacements are incurred.

In 1973, a research program was initiated to improve the quality of vocational guidance and job placement procedures in the Air Force. The specific objectives were to develop a standardized assessment system for measuring vocational interests at point of entry and to evaluate the utility of this information in the selection of an appropriate vocational or technical career field. Initial efforts to construct a suitable instrument for the project were performed under contract with the Educational Testing Service (Echternacht, Reilly, & McCaffrey, 1973). This work led to the development of a general purpose vocational interest inventory designated the Vocational

Interest Career Examination (VOICE). The purpose of this report is to document the construction of factor-referenced homogeneous subscales for the inventory.

The utility of homogeneous scaling has been well documented in past research (Campbell, Borgen, Eastes, Johansson, & Peterson, 1967; Clark, 1961; Kuder, 1942). Given a large number of individual item responses that may be difficult or cumbersome to interpret, it is often desirable to seek some means for summarizing the information using a relatively few descriptive indices. The number and nature of these indices are determined by examining relationships between items, clustering those which seem to measure the same underlying dimension. This approach is analogous to factor-analytic methods which seek to identify common underlying factors among a number of different measurements.

The present study was designed to circumvent several potential problem areas typically encountered in this type of research (see Buros, 1975, for a review of this literature). The initial item pool was sufficiently broad to cover a wide array of vocational and technical interests. Item responses were obtained in the free-, rather than forced-choice format to preclude difficulties with ipsative scoring. Sample sizes were large and differentiated on the basis of sex to permit stable generalizations for both male and female respondents. And finally, rigorous factor-analytic methods were used to provide a sound and replicable basis for the analysis. Specific attention was directed to the following issues: (a) identification of the basic interest dimensions underlying individual item responses to the VOICE, (b) construction of integer weighted subscales to replicate the dimensions, (c) evaluation of the subscales for suitable psychometric properties, and (d) concurrent validation of the scales with other Department of Defense interest inventories.

II. VOICE FACTOR STRUCTURE

Item Pool

The basic data for the analysis consisted of individual responses to the VOICE. The inventory contains 400 multiple-choice items divided into

four general categories: job titles, work tasks, spare time activities, and desired learning experiences. The respondent is asked to indicate relative preferences for each item in a standard like-indifferent-dislike format. Total testing time for completing the inventory is approximately 35 minutes.

Subjects

The inventory was administered to random samples of male (N = 10,035) and female (N = 12,710) recruits during 1973-74 at Lackland Air Force Base, Texas. Subjects ranged in age from 17 to 26 years; most had completed high school or some college. In general, they were representative of all-volunteer recruits entering the Air Force during that time period. Female recruits, which currently represent approximately 13% of accessions, were deliberately over-sampled to obtain sufficient numbers of responses from this group.

Factor Analyses

To establish the factor structure of the inventory, item intercorrelation matrices (400 x 400) were generated separately for the male and female samples. Item responses were coded 3 = like, 2 = indifferent, and 1 = dislike. Each of the matrices was subjected to a principal axis factor analysis with varimax rotation (Veldman, 1967). Various extraction limits were examined to determine the appropriate number and character of the resulting factors. Limits were set to provide 16, 21, 26, and 35 varimax factors.

Results of these analyses were virtually identical for the male and female subgroups at each extraction level. Moreover, the factors extracted at lower limits within each sample appeared to be invariant as more and more factors were extracted and rotated. In the process, 18 orthogonal factors were identified and labeled as shown in Table 1. These factors represented 48% of the original variance in the male sample and 46% in the female sample. The most consistent factors, labeled I through XII in the table, could be seen in the 16-, 21-, 26-, and 35-factor solutions. The remaining factors were most evident in the 26-factor solution as factors XIII through XVIII and XXVI. Representative items for each of the 18 factors are shown in the table together with factor loadings obtained in the male and female subsamples. The order in which the factors are shown corresponds to the degree to which each factor encompassed smaller and smaller item

clusters. The first factor (Office Administration), for example, had more than 60 items in the inventory with associated loadings above .30. The last factor (Automated Data Processing), on the other hand, had approximately seven items above this minimum cutoff.

III. SCALE DEVELOPMENT

Although it would be possible to compute factor scores for each respondent as a means for describing his interests, to do so would not be convenient from an operational point of view. Each score would represent the weighted composite of 400 item responses, each contributing uniquely to the system. The processing of these scores would require access to computing machinery which might not be readily available to the general user.

To simplify scoring individual profiles, an attempt was made to construct integer-weighted subscales which could serve in lieu of the more complex scoring system. These scales would represent the summation of a relatively few items per scale and could be obtained by hand if necessary. Following more or less traditional guidelines, the factor loadings for items within each dimension were rank ordered from highest to lowest. Items were selected to represent a given dimension beginning with those with the highest loadings and continuing until one of two criteria were met: (a) A maximum of 20 items was selected or (b) Item loadings fell below an arbitrary minimum cutoff of .30. As a check on the procedure, supplementary analyses were performed to examine the correspondence between the integer-weighted subscales and their factor score equivalents. Correlations shown in the first column of Table 2 represent the simple bivariate relationships between factors and corresponding scales. The second column reflects the multiple R obtained using all unit-weighted subscales in combination to estimate each of the factor scores.

Scores obtained on the *Office Administration* subscale, for example, correlated .94 with the corresponding factor score. The use of additional subscales increased the correlation to .97 accounting for approximately 94% of the factor-score variance. The bivariate R's ranged from a high of .94 to a low of .49. The multiple R's were all above .90 with the exception of three factors. Across all factors, the amount of information loss resulting from unit-weighted

Table 1. Orthogonal Interest Factors

Factor/Representative Items	Factor Loading	
	Male	Female
I Office Administration		
Keep personnel records on employees	.74	.70
Organize a file system for an office	.72	.73
Take inventory for a department store	.70	.66
II Electronics		
Find a problem in an electric circuit and fix it	.79	.80
Test television tubes	.72	.73
Technician (electronics)	.72	.69
III Heavy Construction		
Pour concrete for highway construction	.69	.61
Operate a bulldozer or power shovel	.64	.58
Construction worker	.62	.55
IV Science		
Write a scientific report	.65	.68
Work in a scientific laboratory	.79	.82
Use chemical laboratory apparatus	.75	.77
V Outdoors		
Go canoeing	.60	.58
Learn survival techniques	.61	.48
Spend a week at the seashore	.67	.61
VI Medical Service		
Perform physical therapy	.59	.62
Assist a surgeon during an operation	.60	.73
Dental hygienist	.55	.57
VII Aesthetics		
See a Broadway play	.48	.50
Read Shakespeare's plays	.59	.57
Listen to an opera	.61	.66
VIII Mechanics		
Tune-up a car	.66	.51
Adjust the brakes on an automobile	.61	.46
Supervise work in a garage	.44	.29
IX Food Service		
Work as a short-order cook	.62	.62
Manage a cafeteria	.45	.54
Chef	.65	.70
X Law Enforcement		
Highway patrolman	.71	.68
Private investigator	.56	.52
Prison guard	.56	.52
XI Audiographics		
Photographer	.65	.69
Operate a 16mm movie camera	.62	.67
Record the sound track for a motion picture	.48	.55

Table 1. Orthogonal Interest Factors

Factor/Representative Items	Factor Loading	
	Male	Female
XII Mathematics		
Solve arithmetic problems	.67	.75
Algebra	.61	.67
Devise short-cut methods for adding numbers	.48	.52
XIII Agriculture		
Farmer	.54	.57
Work as a game warden	.47	.55
Train animals	.41	.54
XIV Teacher/Counseling		
Listen to people's problems and try to help them	.40	.53
Give on-the-job training	.35	.48
Teacher	.36	.49
XV Marksman		
Gunsmith	.55	.55
Go deer hunting	.48	.53
Teach marksmanship	.48	.46
XVI Craftsman		
Tailor	.35	.56
Jeweler	.30	.30
Watchmaker	.34	.24
XVII Drafting		
Draw graphs	.52	.50
Draw maps from photographs	.48	.49
Draw a topographical map of the US	.46	.46
XVIII Automated Data Processing		
Computer operator	.70	.77
Computer programmer	.70	.77
Keypunch operator	.45	.53

Table 2. Relationships Between Orthogonal Interest Factors and VOICE Subscales^a

Factor	Correlations ^b	
	Corresponding VOICE Subscale (R)	All VOICE Subscales Combined (Mult R)
I Office Administration	.94	.97
II Electronics	.94	.98
III Heavy Construction	.88	.96
IV Science	.87	.98
V Outdoors	.83	.93
VI Medical Service	.79	.97
VII Aesthetics	.73	.93
VIII Mechanics	.73	.95
IX Food Service	.79	.96
X Law Enforcement	.84	.95
XI Audiographics	.72	.93
XII Mathematics	.71	.94
XIII Agriculture	.69	.92
XIV Teacher/Counseling	.52	.80
XV Marksman	.69	.86
XVI Craftsman	.49	.71
XVII Drafting	.69	.90
XVIII Automated Data Processing	.65	.90

^aUnit-Weighted.

^bCorrelations indicate the extent of relationship between interest factors, corresponding VOICE subscales (Col 1), and all VOICE subscales combined (Col 2).

scoring (approximately 15%) was considered to be within acceptable limits.

IV. SCALE CHARACTERISTICS

Summary statistics for the VOICE subscales are presented in Table 3. For each scale, the table catalogs the number of items, score range, raw score means and standard deviations by sex group, and internal item consistencies (Cronbach, 1951). As can be noted in the table, the scales range in length from 7 to 20 items. With few exceptions, the internal consistencies (for both the male and female subgroups) range from the high 80's to mid 90's. A comparison of male and female average raw score values indicates that males typically scored higher on Electronics, Heavy Construction, Mechanics, Law Enforcement, and Marksman subscales. Female respondents, as a group, typically scored higher on Office Administration, Medical Service, Aesthetics, Food Service, Audiographics, Agriculture and Teacher/Counseling.

Individual items contained in each scale together with associated item statistics for the male and female subgroups are shown in Appendix A (Table A1).

V. RELATIONSHIPS WITH OTHER DOD INVENTORIES

Recent emphasis on developing common testing procedures across services provided a rationale for analyzing the concurrent validity of the VOICE with respect to comparable instruments from both the Army and Navy. A reference sample consisting of 1,390 recruits (87% male; 13% female) was administered the Navy Vocational Interest Inventory (NVII), the Army Classification Inventory (ACI), and the VOICE. The NVII contains 190 forced-choice item triads that require respondents to select the most and least preferred alternatives presented with each item. As shown in Table 4, the inventory yields nine area scores of the same general type as the 18 homogeneous VOICE

Table 3. VOICE Subscales

Scale	No of Items	Score Range ^a	Males (N = 10,035)			Females (N = 12,710)		
			\bar{x}	SD	α^b	\bar{x}	SD	α^b
Office Administration (OA)	20	20-60	32.32	10.71	.95	37.85	11.46	.95
Electronics (EL)	20	20-60	40.72	12.78	.96	32.50	12.15	.96
Heavy Construction (HC)	20	20-60	34.41	9.99	.93	27.49	8.37	.93
Science (SC)	20	20-60	38.02	12.69	.96	38.21	12.81	.96
Outdoors (OD)	15	15-45	36.47	6.88	.88	36.67	5.76	.83
Medical Service (MS)	20	20-60	33.38	10.55	.94	40.81	11.47	.94
Aesthetics (AE)	15	15-45	26.10	7.74	.90	31.78	7.36	.88
Mechanics (ME)	15	15-45	31.65	8.98	.94	25.10	8.69	.94
Food Service (FS)	15	15-45	21.36	6.30	.90	26.72	7.40	.90
Law Enforcement (LE)	15	15-45	29.22	7.30	.88	26.90	6.89	.86
Audiographics (AU)	10	10-30	20.76	5.79	.90	22.26	5.45	.88
Mathematics (MA)	12	12-36	21.50	7.37	.93	22.06	7.44	.92
Agriculture (AG)	15	15-45	28.00	7.15	.88	31.04	8.00	.90
Teacher/Counseling (TC)	10	10-30	19.32	5.73	.89	22.22	5.31	.86
Marksman (MK)	7	7-21	15.38	4.28	.86	11.54	4.22	.86
Craftsman (CF)	7	7-21	9.88	2.95	.79	11.22	2.96	.72
Drafting (DF)	7	7-21	13.25	4.20	.85	13.08	4.28	.86
Automated Data Processing (DP)	7	7-21	13.76	4.49	.89	13.86	4.39	.88

^aItems scored 3 = Like; 2 = Indifferent; and 1 = Dislike; missing or otherwise invalid responses recoded = 2.

^bAlpha coefficient of internal consistency (uncorrected).

Table 4. Means and Standard Deviations for the VOICE, NVII, and ACI on a Sample of Air Force Recruits (N = 1,390)

VOICE			NVII						ACI		
			Lambda Scores			Area Scores					
Scale	\bar{X}	SD	Subscale	\bar{X}	SD	Subscale	\bar{X}	SD	Subscale	\bar{X}	SD
Office Administration	33	10	Quartermaster	.33	.16	Mechanical	47	9	Combat	18	3
Electronics	42	13	Sonar Technician	.34	.22	Health	53	9	Mechanical	10	5
Heavy Construction	36	10	Electronics Technician	.32	.23	Office	49	8	Electronics	10	5
Science	40	12	Radioman	.33	.18	Electrical	49	9	Administrative	10	3
Outdoors	38	6	Data Processing	.29	.14	Food Service	50	9			
Medical Service	35	10	Store Keeper	.17	.13	Carpentry	47	8			
Aesthetics	27	7	Commissary Man	.24	.14	Sales Office	53	7			
Mechanics	33	9	Engine Man	.30	.26	Clean Hands	50	7			
Food Service	23	6	Boiler Man	.30	.26	Outdoors	45	8			
Law Enforcement	30	7	Electrician's Mate	.32	.25						
Audiographics	22	5	Equipment Operator	.31	.24						
Mathematics	23	7	Aviation Ord Man	.33	.23						
Agriculture	30	7	Air Control man	.34	.17						
Teacher/Counseling	20	5	Aviation Electrician	.33	.24						
Marksman	16	4	Hospital Corpsman	.20	.17						
Craftsman	10	3									
Drafting	14	4									
Auto D. P.	14	4									

subscales. An alternate scoring procedure developed by Dann and Abrahams (1973) yields occupational composites in 15 Navy specialties designated "lambda" scores. The Army's Classification Inventory, as used in their operational selection and classification program, provides interest measures in four general areas: Combat, Mechanical, Electronics, and Administrative. The item format in the ACI is free-response as in the VOICE. Means and standard deviations for the Air Force recruit sample across all three inventories are also shown in Table 4.

Correspondence between inventories was evaluated in two ways. First, simple bivariate correlations between individual VOICE subscales and those of the NVII and ACI were obtained to examine one-to-one relationships among the subscales. Second, a series of multiple correlation analyses were performed to determine the extent to which all scales in a given inventory could be used to replicate individual scales found in another. Six such analyses were conducted as follows:

Predictors	Criteria
VOICE (18)	vs. NVII-Lambda (15)
NVII-Lambda (15)	vs. VOICE (18)
VOICE (18)	vs. NVII-Area (9)
NVII-Area (9)	vs. VOICE (18)
VOICE (18)	vs. ACI (4)
ACI (4)	vs. VOICE (18)

Split sample cross-validations were also performed within each set as a check for over-fitting.

Results of the bivariate correlation analyses, as shown in Table 5, indicated varying degrees of correspondence between individual VOICE subscales and those obtained from other inventories. Correlates above .60 were found for the Office Administration, Electronics, Mechanics, and Mathematics subscales. The Office Administration subscale, for example, correlated .61 with the NVII Office Scale and .61 with the ACI Administrative Scale while the Electronics subscale correlated .68 with the NVII Electronics measure and .69 with the corresponding scale in the ACI. Somewhat lower, but still indicative of significant overlapping variance, were scores on the VOICE Electronics subscale and the NVII Sonar Technician, Electronics Technician, Radio Man, Boiler Man, Electrician's Mate, and Aviation Electrician. The Heavy Construction subscale correlated in the low and mid-fifties with scales on both the NVII and the ACI. The Medical Service subscale correlated .50 with the NVII Hospital Corpsman and .58 with the NVII Health scale. The VOICE Mechanics subscale correlated in the .50 to .66 range with nine of the NVII-Lambda scores, .64 with the NVII Mechanical scale, and .69 with the ACI Mechanical scale. Although other relationships were found, they were, in most cases, not large enough to verify direct one-to-one correspondence between the scales.

Table 5. Correlations Between Scales on the VOICE, NVII and ACI
Based on a Sample of Air Force Recruits (N = 1,390)

Scale	VOICE Scales																	
	OA	EL	HC	SC	OD	MS	AE	ME	FS	LE	AU	MA	AG	TC	MK	CF	DF	DP
NVII - Lambda Scores																		
Quartermaster	-.33	.34	.28	.22	.42	-.12	-.08	.42	-.21	.18	.13	.08	.23	-.04	.36	-.08	.29	.00
Sonar Technician	-.41	.57	.39	.17	.32	-.18	-.19	.58	-.19	.13	.08	.02	.18	-.19	.39	-.02	.19	.03
Electronic Technician	-.41	.58	.39	.21	.31	-.17	-.17	.58	-.18	.12	.09	.05	.19	-.19	.38	-.01	.22	.05
Radio Man	-.30	.54	.31	.15	.31	-.22	-.18	.51	-.24	.13	.09	.07	.12	-.14	.37	-.05	.21	.10
Data Processing	-.13	.40	.22	.18	.32	-.18	-.16	.41	-.24	.11	.06	.22	.08	-.04	.31	-.09	.21	.16
Store Keeper	.41	-.21	-.21	-.14	.03	-.13	-.08	-.18	-.16	.02	-.09	.21	-.18	.16	-.05	-.17	-.07	.17
Commissary Man	-.37	.14	.36	-.12	.33	-.22	-.29	.42	.03	.18	-.09	-.17	.24	-.22	.34	-.12	-.03	-.24
Engine Man	-.44	.49	.51	-.02	.27	-.29	-.32	.66	-.17	.12	-.05	-.11	.17	-.31	.42	-.02	.10	-.09
Boiler Man	-.42	.51	.50	-.01	.27	-.29	-.32	.65	-.28	.12	-.04	-.10	.16	-.30	.42	-.02	.11	-.07
Electrician's Mate	-.42	.57	.46	.06	.28	-.25	-.27	.63	-.18	.11	.01	-.04	.16	-.26	.40	-.01	.14	-.02
Equipment Operator	-.44	.45	.50	-.03	.30	-.29	-.31	.63	-.17	.14	-.05	-.13	.19	-.29	.42	-.04	.11	-.12
Aviation Ordinance Man	-.43	.47	.47	.02	.32	-.27	-.29	.62	-.17	.15	-.02	-.08	.19	-.27	.43	-.04	.13	-.08
Air Control Man	-.35	.37	.29	.23	.42	-.11	-.10	.44	-.20	.20	.13	.07	.21	-.05	.38	-.08	.27	.01
Aviation Electrician	-.41	.57	.44	.11	.30	-.22	-.24	.62	-.19	.12	.04	-.02	.17	-.24	.41	-.01	.17	.01
Hospital Corpsman	-.08	-.08	-.10	.47	.30	.50	.25	-.11	.01	.23	.20	.17	.28	.30	.08	-.06	.16	.02
NVIII - Area Scores																		
Mechanical	-.39	.53	.48	-.06	.14	-.32	-.27	.64	-.13	.02	-.05	-.13	.07	-.34	.33	.04	.09	-.07
Health	.06	-.14	-.18	.45	.08	.58	.27	-.23	.11	.10	.16	.16	.17	.25	-.07	.64	.07	.07
Office	.61	-.32	-.40	-.06	-.23	.07	.12	-.45	-.01	-.14	-.03	.24	-.28	.23	-.30	-.01	-.10	.27
Electrical	-.23	.68	.19	.04	.03	-.23	-.14	.39	-.15	-.03	.08	-.01	-.05	-.22	.18	.04	.07	.17
Food Service	-.11	-.24	-.09	-.10	-.04	.02	.01	-.15	.44	-.01	-.03	-.15	.09	-.05	-.09	-.01	-.13	-.24
Carpentry	-.10	-.25	.25	-.31	.06	-.17	-.14	.09	.07	.01	-.23	-.21	.14	-.10	.08	-.04	-.04	-.32
Sales Office	.17	-.24	-.35	.26	.01	.27	.40	-.41	.08	.03	.23	.18	.00	.37	-.21	.02	.14	.10
Clean Hands	.42	-.24	-.30	-.04	-.15	.09	.09	-.36	-.04	.00	.03	.14	-.22	.20	-.19	-.01	-.06	.22
Outdoors	-.31	.24	.40	-.12	.21	-.19	-.36	.44	-.16	.09	-.24	-.12	.14	-.26	.29	-.10	-.03	-.18
ACI																		
Combat	-.19	.19	.36	.19	.45	.09	.01	.31	-.01	.39	.09	.01	.29	.04	.46	.00	.14	-.04
Mechanical	-.06	.57	.58	.17	.32	.01	.02	.69	.11	.24	.18	.07	.30	.01	.43	.21	.24	.09
Electronics	.20	.69	.24	.55	.26	.23	.29	.34	.13	.17	.35	.64	.21	.32	.24	.25	.43	.46
Administrative	.61	.00	-.19	.26	.05	.29	.35	-.17	.10	.03	.21	.43	-.04	.47	-.09	.16	.18	.38

OA - Office Administration	AE - Aesthetics	AG - Agriculture
EL - Electronics	ME - Mechanics	TC - Teacher/Counseling
HC - Heavy Construction	FS - Food Service	MK - Marksman
SC - Science	LE - Law Enforcement	CF - Craftsman
OD - Outdoors	AU - Audiographics	DF - Drafting
MS - Medical Service	MA - Mathematics	DP - Automated Data Processing

The results of the multiple correlation analysis, shown in Tables A2 through A4 and summarized in Table 6, indicate to what extent scores in a given instrument, when combined in composite form, can be used to replicate scales in other inventories. As can be noted in Table 6, the VOICE subscales generally replicated scores in the NVII and ACI more completely than could these inventories replicate the VOICE scales. In the VOICE versus NVII comparisons, the multiple R's obtained using the VOICE subscales to predict each NVII-Lambda scale, in turn, ranged from .70 to .87. These values are quite high, indicating, in some cases, almost complete replication of the

scales. When the NVII-Lambda scales were used as predictors, only 3 of the 18 VOICE subscales could be estimated with equivalent accuracy. Similar findings were noted in the second and third sets of comparisons. Multiple correlations ranged from .60 to .84 when the VOICE was used to predict the NVII-Area scores and from .62 to .83 when the VOICE was used to predict the four ACI scales. Neither the NVII nor the ACI were able to estimate individual VOICE subscales with the same degree of accuracy.

Split-sample cross-validation of these results, also shown in Tables A2 through A4, indicated the

Table 6. Summary of Multiple Correlation Analyses -
VOICE vs. NVII vs. ACI

Multiple Correlation Range	Frequency Distribution of Multiple Correlations					
	VOICE vs. NVII-Lambda		VOICE vs. NVII-Area		VOICE vs. ACI	
	VOICE ^a vs. NVII-L ^b	NVII-L ^a vs. VOICE ^b	VOICE ^a vs. NVII-A ^b	NVII-A ^a vs. VOICE ^b	VOICE ^a vs. ACI ^b	ACI ^a vs. VOICE ^b
80-89	8		3		2	
70-79	7	3	1	1		3
60-69		4	5	2	2	2
50-59		4		3		5
40-49		6		4		3
30-39				6		3
20-29		1		1		1
10-19				1		1

^aPredictor variables.

^bCriterion Variables.

sample of 1,390 cases was quite stable for purposes of making these generalizations. The amount of shrinkage associated with each multiple correlation was generally found to be negligible, using only a random half-sample on which to construct a composite.

VI. VOICE PROFILES

When vocational interest data are used for comparative purposes, it is often more meaningful to convert raw scores obtained on the subscales to a standardized metric system. Interpretation of interest profiles for an individual or group can be enhanced if the mean and standard deviation of scores obtained on each subscale are fixed at some constant value. Tables A5 and A6 show one such transformation in the form of T-scores where the average value of each subscale for a given reference group is set at 50 and the standard deviation of scores around that average is set at a value of 10. These conversions are based on the normative data for male and female Air Force recruits shown previously in Table 3. A profile of the transformed scores for a randomly selected male recruit is shown in Figure 1. The subscales are listed in the left margin. Across the top of this illustration, the T-score values ranged from 20 to 80 with the larger number indicating a higher affinity for the keyed activities. Both raw scores and T-score equivalents are shown for each subscale. This respondent displays marked preferences for the

Science and Aesthetics subscales. Somewhat lower, but still above average, were scores obtained on the Outdoors, Audiographics, Agriculture, and Teacher/Counseling subscales. Below average scores were noted on Mechanics, Automated Data Processing, Office Administration, and Marksman. Based on the profile, this recruit would probably be more satisfied in an occupation involving natural or social science work than he would be for other occupational choices.

VII. SUMMARY AND CONCLUSIONS

The domain of vocational interests as measured by the VOICE can be characterized by a limited set of dimensions that, in form and substance, are virtually identical for male and female respondents. In the present study, 18 common interest dimensions were identified using factor analytic techniques. The amount of original item variance accounted for by the factors ranged from 48% in the male sample to 46% in the female sample. A simple unit-weighted scoring technique for these dimensions replicated the original factor space almost entirely. Internal consistency value of items within the homogeneous subscales ranged from .79 to .96 for male respondents and from .72 to .96 for female respondents. Normative data based on 10,035 males and 12,710 females indicated that while the subscales may have identical meaning for both sexes, the degree of preference associated with each subscale was not always similar for both

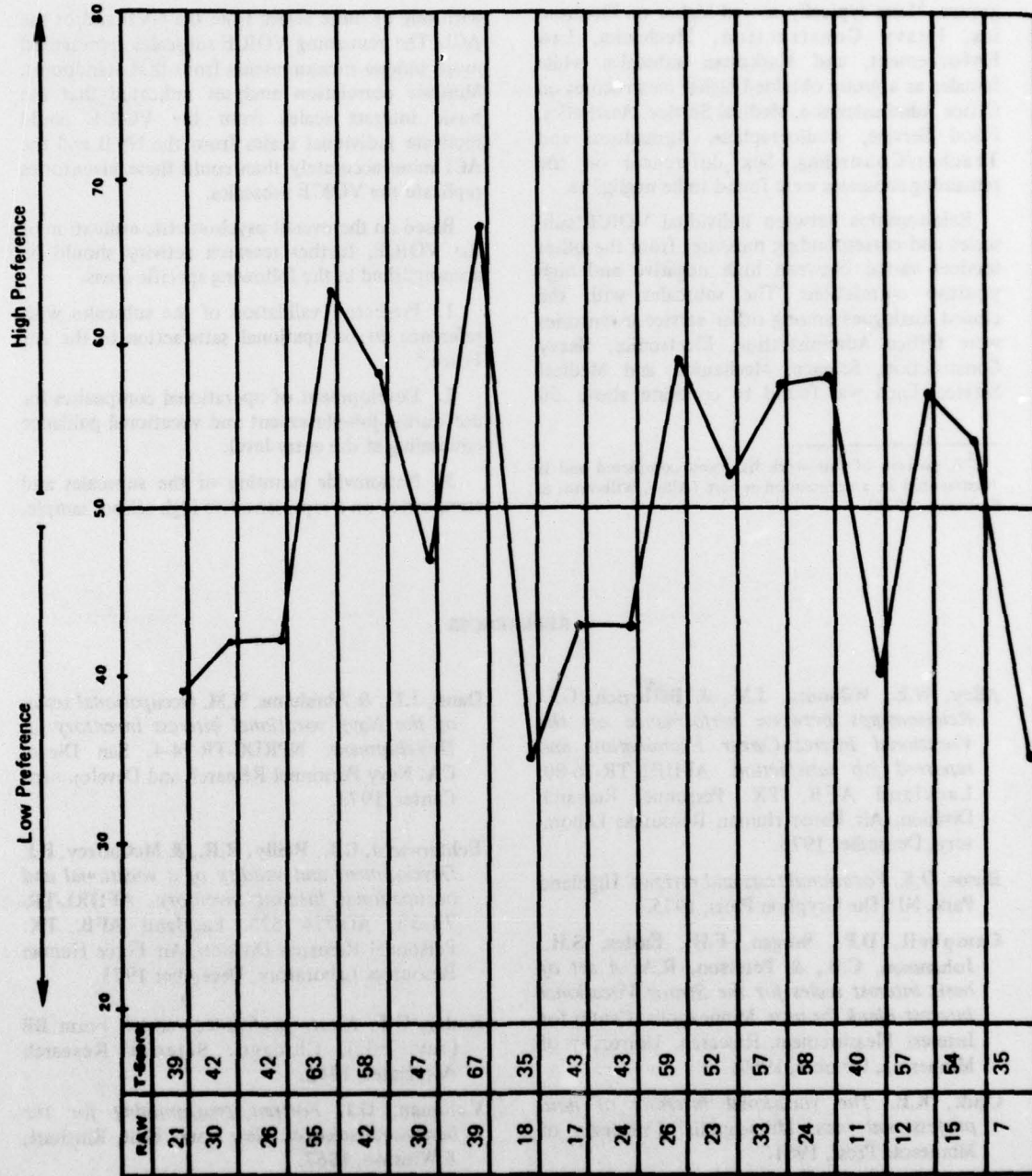


Figure 1. VOICE interest profile.

groups. Males typically scored higher on Electronics, Heavy Construction, Mechanics, Law Enforcement, and Marksman subscales while females as a group obtained higher mean scores on Office Administration, Medical Service, Aesthetics, Food Service, Audiographics, Agriculture and Teacher/Counseling. Sex differences on the remaining subscales were found to be negligible.

Relationships between individual VOICE subscales and corresponding measures from the other services varied between high negative and high positive correlations. The subscales with the closest analogues among other service inventories were Office Administration, Electronics, Heavy Construction, Science, Mechanics, and Medical Service. Each was found to correlate above .50

¹A portion of this work has been completed and is documented in a companion report (Alley, Wilbourn, & Berberich, 1976).

with one or more scales from the NVII and/or the ACI. The remaining VOICE subscales represented more unique measurements from that standpoint. Multiple correlation analyses indicated that the basic interest scales from the VOICE could replicate individual scales from the NVII and the ACI more accurately than could these inventories replicate the VOICE subscales.

Based on the overall psychometric evaluation of the VOICE, further research activity should be accomplished in the following specific areas:

1. Predictive validation of the subscales with reference to occupational satisfaction in the Air Force.¹
2. Development of operational composites for use during job-placement and vocational guidance counseling at the entry-level.
3. Nationwide norming of the subscales and composites on a representative high school sample.

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Table A1. VOICE Item Characteristics for Male and Female Air Force Recruits

No.	Item	Male				Female				No.	Item	Male				Female			
		\bar{X}	SD	RF	\bar{X}	SD	RF	\bar{X}	SD			RF	\bar{X}	SD	RF	\bar{X}	SD	RF	
Office Administration																			
52.	Office worker	1.74	.78	.67	1.98	.82	.71	25.	Electrician	2.31	.78	.68	1.75	.80	.69				
114.	Make out invoices	1.54	.70	.69	1.79	.80	.74	68.	Radio mechanic	2.02	.82	.69	1.60	.76	.73				
137.	Check a list of supplies received against those ordered	1.76	.75	.64	1.92	.79	.67	82.	Technician (electronics)	2.25	.83	.70	1.81	.85	.69				
150.	Balance a checkbook	1.79	.76	.62	2.10	.78	.61	136.	Repair a television set	2.10	.84	.77	1.72	.82	.77				
173.	Make out work schedules	1.68	.73	.65	1.91	.77	.58	145.	Rewire the electrical system in a car	2.12	.84	.67	1.65	.82	.80				
185.	Keep personnel records on employees	1.67	.76	.74	2.02	.82	.70	159.	Repair small electrical motors	2.04	.83	.73	1.66	.81	.82				
187.	Prepare income tax returns for other people	1.51	.72	.65	1.58	.78	.53	163.	Find a problem in an electric circuit and fix it	2.09	.85	.79	1.71	.84	.80				
188.	Make out checks for payment of business bills	1.65	.76	.71	1.94	.83	.72	195.	Repair household electrical appliances	2.00	.84	.77	1.68	.81	.79				
196.	Supervise an inventory of textile goods	1.58	.73	.66	1.59	.74	.55	207.	Install electrical outlets in a building	1.93	.82	.73	1.47	.72	.79				
201.	Prepare a monthly financial statement for a company	1.54	.75	.73	1.70	.82	.68	239.	Design a circuit board	1.87	.85	.66	1.55	.76	.65				
206.	Take inventory for a department store	1.54	.72	.70	1.75	.79	.66	259.	Install a telephone	2.03	.82	.65	1.74	.82	.69				
231.	Make mimeograph copies of a letter	1.56	.71	.62	1.97	.82	.70	260.	Inspect television receivers during assembly for incorrect wiring	1.90	.84	.74	1.50	.73	.73				
241.	File cards alphabetically	1.53	.73	.69	2.05	.84	.69	276.	Find and replace defective transistors	1.99	.85	.79	1.59	.78	.82				
247.	Keep detailed records of expenses for a clothing store	1.51	.71	.72	1.69	.80	.68	277.	Plan an electrical system for a house	2.01	.86	.75	1.54	.77	.76				
248.	Use an adding machine to check hand calculations	1.78	.81	.63	2.14	.86	.66	282.	Test television tubes	1.88	.82	.72	1.58	.75	.73				
263.	Organize a file system for an office	1.55	.73	.72	1.90	.85	.73	323.	Build an antenna for a ham radio set	2.00	.84	.68	1.51	.74	.73				
269.	Schedule appointments for other people	1.59	.72	.68	2.15	.81	.65	336.	Tinker with old radios	2.07	.84	.69	1.65	.81	.73				
273.	Help prepare the payroll for a business	1.61	.75	.74	1.85	.84	.73	338.	Read about electronics	1.97	.83	.68	1.54	.74	.66				
373.	Bookkeeping	1.66	.79	.62	1.98	.85	.65	357.	Build a radio	2.13	.84	.74	1.66	.80	.76				
380.	Efficient methods for filing and retrieving office records	1.54	.73	.71	1.87	.85	.75	400.	Wiring diagrams	2.02	.86	.67	1.61	.79	.66				
Heavy Construction																			
17.	Construction worker	2.05	.81	.62	1.54	.74	.55	70.	Scientist	1.97	.85	.73	1.89	.87	.77				
44.	Lumberjack	1.76	.82	.57	1.40	.69	.54	95.	Write a scientific report	1.66	.79	.65	1.69	.82	.68				
47.	Mason	1.75	.77	.52	1.41	.64	.44	97.	Mix chemical compounds	1.88	.84	.70	1.90	.86	.73				
59.	Plumber	1.72	.76	.52	1.32	.59	.39	103.	Use chemical laboratory apparatus	1.87	.84	.75	1.91	.87	.77				
71.	Sheetmetal worker	1.66	.76	.63	1.21	.49	.47	112.	Record observations from scientific instruments	1.93	.83	.66	2.01	.84	.67				
84.	Toolmaker	1.69	.76	.52	1.31	.58	.38	140.	Work in a scientific laboratory	1.95	.87	.79	2.01	.88	.82				
89.	Welder	1.91	.83	.59	1.36	.64	.44	147.	Perform experiments using laser beams	2.13	.86	.66	1.90	.88	.62				
101.	Dig a ditch	1.29	.56	.52	1.24	.53	.58	192.	Determine concentrations of ethyl alcohol	1.70	.79	.64	1.71	.83	.70				
110.	Clear stumps and brush with a bulldozer	2.01	.84	.64	1.48	.74	.60	199.	Help a scientist perform an experiment	2.00	.86	.75	2.08	.88	.78				
116.	Drive a gasoline truck	1.78	.81	.53	1.35	.64	.47	217.	Devise special scientific equipment for an experiment	1.87	.85	.72	1.75	.85	.70				
132.	Do heavy physical labor	1.67	.72	.54	1.47	.66	.50												

Table A1 (Continued)

No.	Item	Male				Female				Item	Male				Female						
		\bar{X}	SD	RF	Rf	\bar{X}	SD	RF	Rf		\bar{X}	SD	RF	Rf	\bar{X}	SD	RF	Rf			
Heavy Construction (Continued)																					
133.	Help load cartons onto trucks	1.61	.71	.60	1.35	.61	.56	219.	Determine the age of a fossil	1.89	.84	.60	2.04	.87	.60	1.81	.84	.69	2.01	.88	.75
143.	Thread pipe by machine	1.70	.76	.59	1.33	.59	.37	227.	Use a microscope to classify bacteria	1.74	.80	.59	1.89	.85	.61	1.90	.83	.64	1.83	.84	.71
146.	Install heavy machinery in a factory	1.65	.76	.60	1.20	.48	.40	243.	Classify rocks by their physical properties	2.09	.85	.57	2.29	.82	.46	1.88	.85	.66	1.92	.87	.68
177.	Pour concrete for highway construction	1.69	.77	.69	1.40	.66	.61	313.	Read articles about science	1.90	.84	.56	1.94	.86	.53	2.01	.85	.56	1.67	.81	.52
212.	Fill potholes in a street	1.43	.65	.56	1.30	.57	.56	372.	Astronomy	1.93	.85	.63	1.73	.83	.56	1.79	.79	.48	2.20	.81	.54
224.	Operate a bulldozer or power shovel	2.05	.85	.64	1.51	.77	.58	375.	Chemistry	1.86	.84	.51	2.09	.88	.67	2.25	.81	.61	1.81	.84	.48
230.	Help put a new roof on an old house	1.83	.80	.56	1.63	.78	.44	386.	Meteorology	2.07	.84	.63	1.63	.80	.40	2.21	.79	.38	1.82	.83	.28
289.	Apply coats of plaster to walls and ceilings	1.50	.70	.52	1.40	.66	.41	388.	Microscopes	1.80	.81	.40	1.44	.69	.22	1.93	.86	.56	1.44	.72	.33
296.	Rivet sheet metal	1.66	.76	.62	1.28	.57	.43	391.	Nuclear reactors	1.80	.83	.48	2.48	.74	.50	1.88	.83	.48	2.48	.74	.50
395.	Radiation belts in space	1.50	.70	.52	1.40	.66	.41	393.	Performance of emergency medical operations	1.86	.84	.51	2.09	.88	.67	2.12	.83	.61	1.73	.83	.46
Outdoors																					
180.	Work outdoors	2.48	.70	.31	2.56	.67	.35	20.	Dental hygienist	1.52	.72	.55	1.85	.83	.57	1.71	.78	.53	2.23	.82	.58
312.	Go for a 20-mile hike	2.04	.82	.38	2.24	.82	.37	57.	Physical therapist	1.27	.56	.44	1.95	.85	.72	1.68	.76	.57	2.20	.79	.67
319.	Go canoeing	2.49	.74	.60	2.60	.69	.58	62.	Practical nurse	2.06	.80	.44	2.19	.83	.64	1.74	.83	.60	1.97	.90	.73
326.	Go deer hunting	2.38	.82	.39	1.68	.86	.22	99.	Take blood pressure readings	1.95	.82	.58	2.27	.81	.68	1.79	.80	.64	2.20	.84	.77
333.	Ride a trail bike through the woods	2.59	.70	.54	2.63	.68	.53	113.	Give first aid to accident victims	1.66	.80	.44	1.90	.88	.41	1.46	.68	.47	1.81	.83	.46
345.	Go trap shooting	2.25	.84	.45	1.65	.84	.14	142.	Assist a surgeon during an operation	1.67	.75	.47	2.02	.82	.46	1.67	.78	.59	2.17	.85	.62
349.	Exercise for physical fitness	2.29	.75	.42	2.51	.69	.35	154.	Take X-rays of broken bones	1.61	.77	.67	1.90	.88	.77	1.59	.77	.69	1.88	.88	.77
352.	Spend a week at the seashore	2.58	.71	.67	2.86	.44	.61	210.	Work in a hospital	1.52	.73	.47	1.94	.87	.50	1.67	.77	.63	2.05	.86	.74
353.	Go on a picnic	2.54	.69	.65	2.89	.38	.56	213.	Give antirabies shots to dogs	1.51	.72	.60	1.79	.85	.62	1.70	.79	.53	2.19	.83	.55
355.	Go sailing	2.51	.73	.68	2.74	.58	.65	237.	Work out special diets for sick people	1.77	.79	.48	2.20	.81	.54	1.86	.84	.51	2.09	.88	.67
356.	Learn survival techniques for living in the wilderness	2.50	.74	.61	2.55	.71	.48	238.	Test other people's vision using an eye chart	1.61	.77	.67	1.90	.88	.77	2.25	.81	.61	1.81	.84	.48
360.	Be a skydiver	2.23	.85	.41	2.24	.86	.36	244.	Perform physical therapy	1.67	.78	.59	2.17	.85	.62	2.07	.84	.63	1.63	.80	.40
362.	Go fishing	2.49	.73	.50	2.31	.81	.39	249.	Take blood samples from humans	1.61	.77	.67	1.90	.88	.77	2.21	.79	.38	1.82	.83	.28
367.	Play softball	2.46	.74	.50	2.48	.74	.36	256.	Give injections to people for immunizations	1.59	.77	.69	1.88	.88	.77	2.21	.79	.38	1.82	.83	.28
369.	Go camping	2.65	.65	.65	2.73	.59	.60	265.	Supervise activities for mentally ill patients	1.67	.77	.63	2.05	.86	.74	1.93	.86	.56	1.44	.72	.33
303.	Read poetry	1.60	.77	.51	2.26	.82	.43	268.	Help give physical examinations	1.80	.83	.48	2.48	.74	.50	1.88	.83	.48	2.48	.74	.50
306.	Work for a political cause	1.60	.75	.35	1.68	.79	.31	274.	Assist a dentist by cleaning teeth	1.51	.72	.60	1.79	.85	.62	1.70	.79	.53	2.19	.83	.55
307.	Browse through a library	1.86	.81	.41	2.35	.78	.39	278.	Fill prescriptions for a doctor	1.77	.79	.48	2.20	.81	.54	1.86	.84	.51	2.09	.88	.67
310.	Read a novel	2.04	.83	.42	2.60	.68	.37	378.	Disease prevention	1.86	.84	.51	2.09	.88	.67	2.25	.81	.61	1.81	.84	.48
315.	See a Broadway play	1.88	.83	.48	2.48	.74	.50	393.	Performance of emergency medical operations	1.86	.84	.51	2.09	.88	.67	2.25	.81	.61	1.81	.84	.48
316.	Participate in a debate	1.82	.82	.38	1.92	.84	.31	49.	Mechanic (automobile)	2.25	.81	.61	1.81	.84	.48	2.07	.84	.63	1.63	.80	.40
Aesthetics																					
306.	Work for a political cause	1.60	.75	.35	1.68	.79	.31	94.	Replace valves in an engine	2.07	.84	.63	1.63	.80	.40	2.21	.79	.38	1.82	.83	.28
307.	Browse through a library	1.86	.81	.41	2.35	.78	.39	96.	Install a radio in a car	1.80	.81	.40	1.44	.69	.22	1.93	.86	.56	1.44	.72	.33
310.	Read a novel	2.04	.83	.42	2.60	.68	.37	135.	Perform routine maintenance on farm tractors	1.80	.81	.40	1.44	.69	.22	1.93	.86	.56	1.44	.72	.33
315.	See a Broadway play	1.88	.83	.48	2.48	.74	.50	148.	Overhaul a tractor engine	1.80	.81	.40	1.44	.69	.22	1.93	.86	.56	1.44	.72	.33
316.	Participate in a debate	1.82	.82	.38	1.92	.84	.31	155.	Adjust the brakes on an automobile	2.12	.83	.61	1.73	.83	.46	2.21	.79	.38	1.82	.83	.28

Table A1 (Continued)

No.	Item	Male					Female								
		\bar{X}	SD	RF	\bar{X}	SD	RF	\bar{X}	SD	RF	\bar{X}	SD	RF		
Aesthetics (Continued)															
321.	Discuss a painting	1.69	.78	.48	2.00	.85	.46	209.	Supervise work in a garage	1.82	.81	.44	1.45	.69	.29
329.	Read Shakespeare's plays	1.59	.76	.59	2.03	.85	.57	290.	Design a dragster	2.20	.85	.46	1.68	.84	.27
335.	Listen to an opera	1.44	.69	.61	1.67	.81	.66	305.	Write articles for automobile magazines	1.72	.80	.43	1.39	.65	.27
339.	Watch educational television	1.85	.79	.40	2.03	.80	.33	331.	Tune-up a car	2.32	.81	.66	1.76	.86	.51
342.	Tune a musical instrument	1.81	.84	.38	1.88	.85	.41	334.	Watch drag racing	2.44	.80	.40	2.20	.85	.22
346.	Read short stories	2.09	.83	.44	2.64	.65	.34	343.	Change the oil in a car	2.20	.80	.60	1.82	.85	.50
347.	Go to a symphony concert	1.67	.81	.63	2.05	.88	.72	344.	Rebuild a lawn-mower engine	2.09	.86	.54	1.47	.73	.24
351.	Watch a ballet	1.43	.70	.58	2.04	.87	.67	348.	Adjust a carburetor	2.22	.83	.65	1.72	.84	.49
377.	Classical music	1.73	.81	.58	2.14	.84	.68	384.	How different types of engines work	2.24	.84	.56	1.75	.84	.38
Mechanics (Continued)															
Food Service															
6.	Baker	1.43	.66	.62	1.77	.79	.67	4.	Ambulance driver	1.86	.82	.37	1.64	.77	.37
13.	Chef	1.52	.72	.65	1.73	.81	.70	19.	Customs agent	1.91	.79	.40	2.10	.79	.32
86.	Waiter	1.22	.50	.42	1.39	.64	.40	27.	Explosives detonator	1.84	.83	.33	1.37	.66	.31
121.	Mix pancake batter	1.30	.58	.62	1.77	.81	.64	30.	Fire fighter	2.00	.80	.48	1.66	.78	.48
127.	Plan menus	1.34	.61	.50	1.79	.81	.64	31.	Fire inspector	1.86	.77	.39	1.62	.72	.40
167.	Decorate cakes	1.36	.62	.64	2.16	.83	.59	36.	Highway patrolman	2.18	.83	.71	1.91	.84	.68
179.	Carry out dirty dishes in a restaurant	1.16	.43	.39	1.22	.49	.37	60.	Policeman	2.08	.84	.75	2.03	.86	.69
234.	Manage a cafeteria	1.43	.66	.45	1.50	.71	.54	64.	Prison guard	1.47	.72	.56	1.31	.62	.52
253.	Work as a short-order cook	1.34	.61	.62	1.39	.67	.62	65.	Private investigator	2.21	.83	.56	2.17	.85	.52
264.	Run a food catering service	1.37	.63	.52	1.48	.72	.64	100.	Investigate insurance claims	1.92	.84	.43	1.90	.83	.40
297.	Make ice cream	1.60	.74	.45	2.11	.84	.55	128.	Arrest a traffic violator	1.98	.82	.69	1.89	.83	.65
324.	Improve a recipe	1.51	.72	.52	2.19	.84	.56	130.	Be a witness at a criminal trial	1.77	.76	.46	1.74	.78	.50
328.	Buy food for a cookout	1.77	.78	.39	2.35	.79	.48	144.	Help rescue someone from a fire	2.31	.77	.42	2.19	.81	.41
376.	Chinese cooking	1.56	.75	.45	2.11	.86	.48	160.	Stop a prison riot	1.65	.80	.62	1.46	.73	.54
381.	Food processing	1.46	.67	.51	1.77	.81	.65	184.	Fight a forest fire	2.17	.82	.42	1.92	.85	.42
Law Enforcement															
Mathematics															
55.	Photoengraver	1.68	.74	.43	1.86	.77	.45	91.	Find information in numerical tables	1.64	.76	.38	1.82	.81	.44
56.	Photographer	2.24	.80	.65	2.54	.68	.69	105.	Construct mathematical tables	1.63	.78	.55	1.59	.79	.66
83.	Television cameraman	2.24	.81	.47	2.15	.83	.52	156.	Solve arithmetic problems	1.86	.83	.67	1.93	.86	.75
115.	Take aerial photographs	2.35	.79	.54	2.43	.76	.57	166.	Work with numbers	1.89	.82	.63	2.01	.85	.72
141.	Draw maps from photographs	1.85	.83	.30	1.93	.85	.29	169.	Use a table of logarithms to solve a mathematics problem	1.68	.80	.63	1.66	.82	.69
157.	Operate a 16mm movie camera	2.21	.78	.62	2.42	.74	.67	242.	Correct errors made by another person in an arithmetic problem	1.65	.78	.50	1.87	.85	.58
158.	Repair cameras	1.93	.81	.50	1.83	.82	.42	301.	Devise shortcut methods for adding numbers	1.78	.84	.48	1.86	.87	.52
225.	Record the sound track for a motion picture	2.14	.83	.48	2.27	.80	.55	340.	Solve geometry problems	1.71	.80	.57	1.62	.80	.64
228.	Develop photographs	2.09	.83	.63	2.46	.74	.69	371.	Algebra	2.01	.81	.61	2.08	.89	.67
358.	Join a photography club	1.69	.77	.55	2.38	.78	.64	374.	Calculus	1.68	.80	.56	1.66	.81	.61
								389.	How to multiply numbers on a desk calculator	1.96	.85	.42	2.12	.86	.46
								399.	Use of a slide rule	1.98	.84	.44	1.84	.85	.51

Table A1 (Continued)

No.	Item	Male				Female			
		\bar{X}	SD	Rf	Rf	\bar{X}	SD	Rf	Rf
Agriculture									
29.	Farmer	1.77	.81	.54	1.89	.84	.57		
33.	Forest ranger	2.39	.77	.50	2.23	.84	.56		
34.	Gardener	1.55	.72	.52	1.97	.83	.56		
85.	Veterinarian	1.82	.84	.39	2.16	.86	.49		
106.	Work as a game warden	2.31	.83	.47	2.14	.87	.55		
123.	Train animals	2.02	.84	.41	2.34	.82	.54		
124.	Pick fruit in an orchard	1.35	.60	.32	1.73	.78	.40		
125.	Mow lawns, chip hedges and bushes, and trim trees	1.42	.65	.34	1.66	.78	.44		
172.	Drive a tractor on a farm	1.86	.84	.40	1.79	.85	.42		
180.	Work outdoors	2.48	.70	.30	2.56	.67	.43		
189.	Plant trees in a forest	2.11	.83	.51	2.20	.84	.60		
213.	Give antirabies shots to dogs	1.66	.80	.33	1.90	.88	.41		
232.	Experiment on plants with different types of fertilizer	1.78	.80	.38	2.04	.85	.43		
302.	Plant and take care of a vegetable garden	1.73	.80	.52	2.29	.82	.51		
396.	How to raise tropical plants	1.76	.80	.35	2.15	.84	.42		
Marksmanship									
35.	Gunsmith	2.05	.81	.56	1.52	.73	.55		
119.	Teach marksmanship	2.16	.82	.48	1.87	.85	.46		
246.	Replace defective parts on a rifle	2.04	.82	.47	1.56	.76	.46		
326.	Go deer hunting	2.38	.82	.48	1.68	.86	.53		
345.	Go trap shooting	2.25	.84	.44	1.65	.84	.57		
363.	Collect rifles and pistols	2.28	.82	.58	1.60	.80	.70		
368.	Belong to a gun club	2.23	.83	.58	1.66	.83	.71		
Drafting									
5.	Artist	1.83	.85	.33	2.16	.85	.46		
22.	Draftsman	2.02	.81	.60	1.70	.78	.49		
104.	Draw blueprints for a bridge	2.01	.84	.61	1.81	.84	.51		
134.	Draw graphs	1.82	.80	.52	1.82	.81	.50		
141.	Draw maps from photographs	1.85	.83	.48	1.93	.85	.49		
175.	Make drawings with a compass, triangle, ruler, and other instruments	2.00	.85	.55	1.94	.87	.45		
222.	Draw a topographical map of the United States	1.73	.79	.46	1.73	.82	.46		
Teacher/Counseling									
80.	Teacher	1.90	.83	.36	2.12	.82	.49		
170.	Give on-the-job training	2.20	.76	.35	2.31	.75	.48		
183.	Teach someone to read	1.91	.82	.38	2.39	.77	.54		
211.	Teach someone how to solve a problem	2.04	.81	.43	2.30	.79	.56		
215.	Organize and lead a study group	1.69	.77	.37	1.93	.82	.59		
229.	Give a talk before a small group	1.77	.78	.39	1.97	.82	.57		
235.	Help a high school student with his homework	1.89	.78	.38	2.24	.77	.55		
254.	Listen to people's problems and try to help them	2.03	.83	.40	2.44	.75	.53		
257.	Solve problems by analyzing them logically	1.97	.85	.31	2.25	.82	.41		
300.	Organize recreational activities for a group of people	1.92	.83	.32	2.26	.81	.52		
Craftsman									
38.	Jeweler	1.63	.74	.30	2.09	.80	.30		
63.	Printer	1.56	.71	.31	1.67	.74	.10		
73.	Shoe repairman	1.27	.53	.39	1.22	.49	.24		
75.	Steam fitter	1.34	.59	.30	1.15	.40	.16		
78.	Tailor	1.36	.62	.35	1.55	.74	.56		
87.	Watchmaker	1.50	.70	.34	1.48	.69	.24		
98.	Sew clothes from patterns	1.22	.52	.28	2.06	.87	.60		
Automated Data Processing									
15.	Computer operator	2.26	.79	.70	2.26	.79	.77		
16.	Computer programmer	2.23	.80	.70	2.22	.80	.77		
39.	Keypunch operator	1.71	.79	.45	2.01	.84	.53		
151.	Write a computer program	1.92	.85	.51	1.93	.84	.59		
174.	Find the errors in a computer program	1.91	.85	.44	1.86	.84	.52		
250.	Operate a machine that sorts punched cards	1.75	.80	.34	1.92	.84	.42		
262.	Perform maintenance on a computer	1.99	.85	.41	1.65	.79	.39		

Table A2. Multiple Correlation Analysis – VOICE vs. NVII-Lambda Scales

VOICE to Predict NVII-Lambda				NVII-Lambda to Predict VOICE			
Subscale	Multiple R			Subscale	Multiple R		
	Full	HS1	CV		Full	HS1	CV
Quartermaster	.73	.71	.75	Office Admin.	.65	.66	.63
Sonar Tech.	.84	.82	.84	Electronics	.75	.74	.74
Electronics Tech.	.84	.84	.84	Hvy Construction	.61	.63	.58
Radio Man	.79	.78	.78	Science	.71	.73	.69
Data Processing	.71	.70	.70	Outdoors	.48	.48	.47
Store Keeper	.72	.73	.69	Med. Svc.	.66	.69	.62
Commissary Man	.70	.70	.69	Aesthetics	.53	.55	.50
Engine Man	.87	.87	.86	Mechanics	.70	.70	.69
Boiler Man	.86	.87	.85	Food Service	.49	.51	.46
Electrician's Mate	.85	.85	.85	Law Enforce.	.40	.40	.39
Equip. Operator	.85	.85	.84	Audiographics	.45	.44	.45
Aviation Ord. Man	.84	.84	.84	Mathematics	.64	.65	.62
Air Control Man	.75	.72	.75	Agriculture	.47	.48	.46
Aviation Elect.	.85	.84	.85	Teach/Counsel	.50	.52	.47
Hospital Corpsman	.78	.80	.76	Marksman	.49	.49	.47
				Craftsman	.28	.30	.22
				Draftsman	.58	.59	.57
				Auto. Data Proc.	.57	.57	.56

Full – Full sample (N = 1,390) HS1 – Half sample 1 (N = 695) CV – Results from half sample 1 cross-validated to half sample 2.

Table A3. Multiple Correlation Analysis – VOICE vs. NVII-Area Scales

VOICE to Predict NVII Area				NVII Area to Predict VOICE			
Subscale	Multiple R			Subscale	Multiple R		
	Full	HS1	CV		Full	HS1	CV
Mechanical	.84	.85	.83	Office Admin.	.62	.62	.62
Health	.78	.81	.73	Electronics	.71	.71	.71
Office	.82	.82	.81	Hvy Construction	.56	.57	.53
Electrical	.81	.82	.81	Science	.57	.58	.55
Food Service	.66	.69	.63	Outdoors	.32	.33	.28
Carpentry	.60	.62	.58	Med. Svc.	.59	.63	.55
Sales Office	.67	.71	.62	Aesthetics	.48	.52	.42
Clean Hands	.61	.63	.57	Mechanics	.66	.67	.63
Outdoors	.69	.70	.66	Food Service	.45	.49	.41
				Law Enforce.	.22	.20	.20
				Audiographics	.39	.40	.36
				Mathematics	.39	.40	.37
				Agriculture	.37	.39	.36
				Teach/Counsel	.44	.47	.39
				Marksman	.37	.41	.35
				Craftsman	.17	.20	.10
				Draftsman	.32	.33	.28
				Auto. Data Proc.	.49	.48	.50

Full – Full sample (N = 1,390) HS1 – Half sample 1 (N = 695) CV – Results from half sample 1 cross-validated to half sample 2.

Table A4. Multiple Correlation Analysis - VOICE vs. ACI Scales

Subscale	VOICE to Predict ACI			ACI to Predict VOICE			
	Full	Multiple R		Subscale	Full	Multiple R	
		HS1	CV			HS1	CV
Combat	.62	.62	.60	Office Admin.	.63	.64	.62
Mechanical	.81	.82	.78	Electronics	.75	.75	.75
Electronics	.83	.84	.83	Hvy Construction	.62	.64	.60
Administrative	.69	.72	.66	Science	.59	.58	.59
				Outdoors	.51	.52	.50
				Med. Svc.	.26	.26	.26
				Aesthetics	.42	.44	.39
				Mechanics	.79	.81	.77
				Food Service	.17	.14	.17
				Law Enforce.	.42	.41	.42
				Audiographics	.39	.36	.41
				Mathematics	.73	.73	.71
				Agriculture	.39	.37	.37
				Teach/Counsel	.53	.53	.53
				Marksman	.56	.58	.52
				Craftsman	.32	.30	.32
				Draftsman	.45	.45	.45
				Auto. Data Proc.	.56	.57	.55

Full - Full sample (N = 1,390) HS1 - Half sample 1 (N = 695) CV - Results from half sample 1 cross-validated to half sample 2.

Table A5. T-Score Conversion Tables for Male Air Force Recruits

Raw	Office Administration		Electronics		Heavy Construction		Science		Outdoors		Medical Service		Aesthetics		Mechanics		Food Service	
	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw
20	38	20	34	20	37	20	36	15	19	20	37	15	36	15	31	15	40	
21	39	21	35	21	38	21	37	16	20	21	38	16	37	16	33	16	41	
22	40	22	35	22	39	22	37	17	22	22	39	17	38	17	34	17	43	
23	41	23	36	23	40	23	38	18	23	23	40	18	40	18	35	18	45	
24	42	24	37	24	40	24	39	19	25	24	41	19	41	19	36	19	46	
25	43	25	38	25	41	25	40	20	26	25	42	20	42	20	37	20	48	
26	44	26	38	26	42	26	41	21	28	26	43	21	43	21	38	21	49	
27	45	27	39	27	43	27	41	22	29	27	44	22	45	22	39	22	51	
28	46	28	40	28	44	28	42	23	30	28	45	23	46	23	40	23	53	
29	47	29	41	29	45	29	43	24	32	29	46	24	47	24	41	24	54	
30	48	30	42	30	46	30	44	25	33	30	47	25	49	25	43	25	56	
31	49	31	42	31	47	31	44	26	35	31	48	26	50	26	44	26	57	
32	50	32	43	32	48	32	45	27	36	32	49	27	51	27	45	27	59	
33	51	33	44	33	49	33	46	28	38	33	50	28	52	28	46	28	61	
34	52	34	45	34	50	34	47	29	39	34	51	29	54	29	47	29	62	
35	52	35	46	35	51	35	48	30	41	35	52	30	55	30	48	30	64	
36	53	36	46	36	52	36	48	31	42	36	52	31	56	31	49	31	65	
37	54	37	47	37	53	37	49	32	43	37	53	32	58	32	50	32	67	
38	55	38	48	38	54	38	50	33	45	38	54	33	59	33	51	33	68	
39	56	39	49	39	55	39	51	34	46	39	55	34	60	34	53	34	70	
40	57	40	49	40	56	40	52	35	48	40	56	35	62	35	54	35	72	
41	58	41	50	41	57	41	52	36	49	41	57	36	63	36	55	36	73	
42	59	42	51	42	58	42	53	37	51	42	58	37	64	37	56	37	75	
43	60	43	52	43	59	43	54	38	52	43	59	38	65	38	57	38	76	
44	61	44	53	44	60	44	55	39	54	44	60	39	67	39	58	39	78	
45	62	45	53	45	61	45	56	40	55	45	61	40	68	40	59	40	80	
46	63	46	54	46	62	46	56	41	57	46	62	41	69	41	60	41	81	
47	64	47	55	47	63	47	57	42	58	47	63	42	71	42	62	42	83	
48	65	48	56	48	64	48	58	43	59	48	64	43	72	43	63	43	84	
49	66	49	56	49	65	49	59	44	61	49	65	44	73	44	64	44	86	
50	67	50	57	50	66	50	59	45	62	50	66	45	74	45	65	45	87	
51	67	51	58	51	67	51	60	45	62	51	67	45	74	45	65	45	87	
52	68	52	59	52	68	52	61	45	62	52	68	45	74	45	65	45	87	
53	69	53	60	53	69	53	62	45	62	53	69	45	74	45	65	45	87	
54	70	54	60	54	70	54	63	45	62	54	70	45	74	45	65	45	87	
55	71	55	61	55	71	55	63	45	62	55	70	45	74	45	65	45	87	
56	72	56	62	56	72	56	64	45	62	56	71	45	74	45	65	45	87	
57	73	57	63	57	73	57	65	45	62	57	72	45	74	45	65	45	87	
58	74	58	64	58	74	58	66	45	62	58	73	45	74	45	65	45	87	
59	75	59	64	59	75	59	67	45	62	59	74	45	74	45	65	45	87	
60	76	60	65	60	76	60	67	45	62	60	75	45	74	45	65	45	87	

Table AS (Continued)

Raw	Basic Business Math		Arithmetic		Mathematics		Agriculture		Teacher/Counseling		Mechanics		Craftsmen		Drafting		Automated Data Processing	
	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw
15	31	10	31	15	32	12	37	31	10	34	7	30	7	40	7	35	7	35
16	32	11	33	16	33	13	38	16	11	35	8	33	8	44	8	37	8	37
17	33	12	35	17	35	14	40	17	12	37	9	35	9	47	9	40	9	39
18	35	13	37	18	36	15	41	18	13	39	10	37	10	50	10	42	10	42
19	36	14	38	19	37	16	43	19	14	41	11	40	11	54	11	45	11	44
20	37	15	40	20	39	17	44	20	15	42	12	42	12	57	12	47	12	46
21	39	16	42	21	40	18	45	21	16	44	13	44	13	61	13	49	13	48
22	40	17	44	22	42	19	47	22	17	46	14	47	14	64	14	52	14	51
23	41	18	45	23	43	20	48	23	18	48	15	49	15	67	15	54	15	53
24	43	19	47	24	44	21	49	24	19	49	16	51	16	71	16	57	16	55
25	44	20	49	25	46	22	51	25	20	51	17	54	17	74	17	59	17	57
26	45	21	50	26	47	23	52	26	21	53	18	56	18	78	18	61	18	59
27	47	22	52	27	49	24	53	27	22	55	19	58	19	81	19	64	19	62
28	48	23	54	28	50	25	55	28	23	56	20	61	20	84	20	66	20	64
29	49	24	56	29	51	26	56	29	24	58	21	63	21	88	21	68	21	66
30	51	25	57	30	53	27	57	30	25	60								
31	52	26	59	31	54	28	59	31	26	62								
32	54	27	61	32	56	29	60	32	27	63								
33	55	28	63	33	57	30	62	33	28	65								
34	56	29	64	34	58	31	63	34	29	67								
35	58	30	66	35	60	32	64	35	30	69								
36	59			36	61	33	66	36										
37	60			37	63	34	67	37										
38	62			38	64	35	68	38										
39	63			39	65	36	70	39										
40	64			40	67			40										
41	66			41	68			41										
42	67			42	70			42										
43	68			43	71			43										
44	70			44	72			44										
45	71			45	74			45										

Table A6. T-Score Conversion Tables for Female Air Forces Recruits

Raw	Office Administration		Heavy Construction		Sculpture		Outdoors		Musical Services		Aesthetics		Mechanics		Food Services	
	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw
20	34	20	41	20	20	36	15	12	20	32	15	27	15	38	15	34
21	35	21	42	21	21	37	16	14	21	33	16	29	16	40	16	36
22	36	22	43	22	22	37	17	16	22	34	17	30	17	41	17	37
23	37	23	43	23	23	38	18	18	23	34	18	31	18	42	18	38
24	38	24	46	24	24	39	19	19	24	35	19	33	19	43	19	40
25	39	25	44	25	25	40	20	21	25	36	20	34	20	44	20	41
26	40	26	48	26	26	40	21	23	26	37	21	35	21	45	21	42
27	41	27	49	27	27	41	22	25	27	38	22	37	22	46	22	44
28	41	28	46	28	28	42	23	26	28	39	23	38	23	48	23	45
29	42	29	47	29	29	43	24	28	29	40	24	39	24	49	24	46
30	43	30	48	30	30	44	25	30	30	41	25	41	25	50	25	48
31	44	31	49	31	31	44	26	31	31	41	26	42	26	51	26	49
32	45	32	50	32	32	45	27	33	32	42	27	44	27	52	27	50
33	46	33	50	33	33	46	28	35	33	43	28	45	28	53	28	52
34	47	34	51	34	34	47	29	37	34	44	29	46	29	54	29	53
35	48	35	52	35	35	47	30	38	35	45	30	48	30	56	30	54
36	48	36	53	36	36	48	31	40	36	46	31	49	31	57	31	56
37	49	37	54	37	37	49	32	42	37	47	32	50	32	58	32	57
38	50	38	55	38	38	50	33	44	38	48	33	52	33	59	33	58
39	51	39	55	39	39	51	34	45	39	48	34	53	34	60	34	60
40	52	40	56	40	40	51	35	47	40	49	35	54	35	61	35	61
41	53	41	57	41	41	52	36	49	41	50	36	56	36	63	36	63
42	54	42	58	42	42	53	37	51	42	51	37	57	37	64	37	64
43	54	43	59	43	43	54	38	52	43	52	38	58	38	65	38	65
44	55	44	59	44	44	55	39	54	44	53	39	60	39	66	39	67
45	56	45	60	45	45	55	40	56	45	54	40	61	40	67	40	68
46	57	46	61	46	46	56	41	58	46	55	41	63	41	68	41	69
47	58	47	62	47	47	57	42	59	47	56	42	64	42	69	42	71
48	59	48	63	48	48	58	43	61	48	56	43	65	43	71	43	72
49	60	49	64	49	49	58	44	63	49	57	44	66	44	72	44	73
50	61	50	64	50	50	59	45	64	50	58	45	68	45	73	45	75
51	61	51	65	51	51	60	45	64	51	59	45	68	45	73	45	75
52	62	52	66	52	52	61	46	64	52	60	46	68	46	73	46	75
53	63	53	67	53	53	62	46	64	53	61	46	68	46	73	46	75
54	64	54	68	54	54	62	47	64	54	61	47	69	47	73	47	75
55	65	55	69	55	55	63	47	64	55	62	47	69	47	73	47	75
56	66	56	69	56	56	64	48	64	56	63	48	70	48	73	48	75
57	67	57	70	57	57	65	48	64	57	64	48	71	48	73	48	75
58	68	58	71	58	58	65	49	64	58	64	49	71	49	73	49	75
59	68	59	72	59	59	66	49	64	59	65	49	72	49	73	49	75
60	69	60	73	60	60	67	50	64	60	66	50	72	50	73	50	75

Table A6 (Continued)

Law Enforcement	Audio-graphics		Mathematics		Agriculture		Teacher/Counseling		Marksman		Craftsman		Draftsman		Automated Data Processing	
	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T	Raw	T
15	33	27	12	36	15	30	10	27	7	39	7	36	7	36	7	34
16	34	29	13	38	16	32	11	29	8	41	8	39	8	38	8	37
17	36	31	14	39	17	33	12	31	9	44	9	42	9	40	9	39
18	37	33	15	41	18	34	13	33	10	46	10	46	10	43	10	41
19	39	35	16	42	19	35	14	35	11	49	11	49	11	45	11	43
20	40	37	17	43	20	36	15	36	12	51	12	53	12	47	12	46
21	41	39	18	45	21	37	16	38	13	53	13	56	13	50	13	48
22	43	40	19	46	22	39	17	40	14	56	14	59	14	52	14	50
23	44	42	20	47	23	40	18	42	15	58	15	63	15	54	15	53
24	46	44	21	49	24	41	19	44	16	61	16	66	16	57	16	55
25	47	46	22	50	25	42	20	46	17	63	17	70	17	59	17	57
26	49	48	23	51	26	44	21	48	18	65	18	73	18	61	18	59
27	50	50	24	53	27	45	22	50	19	68	19	76	19	64	19	62
28	52	51	25	54	28	46	23	51	20	70	20	80	20	66	20	64
29	53	53	26	55	29	47	24	53	21	72	21	83	21	69	21	66
30	55	55	27	57	30	49	25	55								
31	56	57	28	58	31	50	26	57								
32	57	59	29	59	32	51	27	59								
33	59	61	30	61	33	52	28	61								
34	60	62	31	62	34	54	29	63								
35	62	64	32	63	35	55	30	65								
36	63	65	33	65	36	56	30	65								
37	65	66	34	66	37	57	31	66								
38	66	67	35	67	38	59	32	67								
39	68	69	36	69	39	60	33	69								
40	69	70	37	70	40	61	34	70								
41	70	71	38	71	41	62	35	71								
42	72	72	39	72	42	64	36	72								
43	73	73	40	73	43	65	37	73								
44	74	74	41	74	44	66	38	74								
45	75	75	42	75	45	67	39	75								