NPRDC TR 74-4 October 1973

OCCUPATIONAL SCALES OF THE NAVY VOCATIONAL INTEREST INVENTORY: I. DEVELOPMENT

Joyce E. Dann
Norman M. Abrahams

Work Unit No. P43-07X.06

Reviewed by

M. F. Wiskoff, PhD, Associate Director
Personnel Utilization

Approved by

E. M. Ramras, Deputy Technical Director
Manpower and Personnel

Navy Personnel Research and Development Center
San Diego, California 92152

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: TR 74-4	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): OCCUPATIONAL SCALES OF THE NAVY VOCATIONAL INTEREST INVENTORY: I. DEVELOPMENT	5. TYPE OF REPORT & PERIOD COVERED: Final
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Joyce E. Dann, Norman M. Abrahams	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Navy Personnel Research and Development Center, San Diego, California 92152	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 63707N, P43-07X.06
11. CONTROLLING OFFICE NAME AND ADDRESS: Navy Personnel Research and Development Center, San Diego, California 92152	12. REPORT DATE: October 1973
	13. NUMBER OF PAGES: 39
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Navy Vocational Interest Inventory
Lambda interest scales
Enlisted classification
Interest measurement
Interest scale development
Verification scale

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Each year, thousands of enlisted recruits enter the Navy and, with little or no Navy experience, must indicate the ratings they would like to pursue for most of their military careers. The Navy Vocational Interest Inventory (NVII) was constructed to help these recruits determine the ratings which correspond most closely with their vocational preferences and in which they would probably be most satisfied.

The present report describes the development of 15 occupational scales for the NVII which yield scores based upon a modification of the point-biserial

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. ABSTRACT (continued)

correlation and reflect the extent to which an individual's interests resemble the interests of satisfied men in 15 different Navy ratings.

Intercorrelations among the scales were determined and were generally higher than those for the Strong Vocational Interest Blank or the Kuder Occupational Interest Survey. The median intra-individual standard error of measurement was .027. Based upon this median, a one per cent confidence interval, and a two-tailed t test, a difference of .07 or more between two scores can be considered a true difference.

Correlations between scores based on part and those based on all of the NVII items were also calculated and indicate that usable scores can be derived from incomplete answer sheets.

Various techniques designed to detect improperly completed answer sheets were tried, with the magnitude of an individual's highest score on the 15 occupational scales providing most efficient discrimination of the techniques evaluated.

SUMMARY

Problem

Each year, thousands of enlisted recruits enter the Navy and, with little or no Navy experience, must indicate the ratings they would like to pursue for most of their military careers. A vocational interest inventory designed to facilitate and enhance the decision-making process would increase the individual's job satisfaction and would benefit the Navy in terms of more efficient utilization of manpower.

Background

The Navy Vocational Interest Inventory (NVII) was constructed with these goals in mind to help recruits determine the ratings which correspond most closely with their vocational preferences and in which they would probably be most satisfied.

The present report describes the development of 15 occupational scales for the NVII which were designed to reflect the degree of relationship between an individual's interests and the interests of men in 15 diverse Navy ratings.

Approach

To construct these scales, large groups of first and second-term enlistees in each of 15 ratings were administered the NVII. Individuals from this group who indicated that they were satisfied with their rating and were doing work typical for that rating were used to construct the occupational scales. An individual's score on one of these scales reflects the extent to which his interests correspond with the interests of satisfied men in the rating.

Findings, Conclusions, and Recommendations

Intercorrelations among the 15 scales were determined and were generally higher than those for the Strong Vocational Interest Blank or the Kuder Occupational Interest Survey. Other statistical characteristics of the scales indicate that two scores can be considered different from each other if they are .07 or more points apart.

Correlations between scale scores based on part and those based on all of the NVII items were also computed. These correlations were high enough to indicate that usable scores can be derived from incomplete answer sheets, and it is recommended that such answer sheets be scored (page 17).

Special verification scales designed to identify carelessly or improperly completed answer sheets were also developed, but none proved as discriminating for this purpose as considering only the magnitude of the individual's highest interest score. It is therefore recommended that the magnitude of the individual's highest score be used to detect poorly completed answer sheets (page 17).

In general, the 15 occupational scales of the NVII appear promising for use in guiding individuals into appropriate Navy ratings and will probably be recommended for operational use in the near future. However, before implementation is advised, research currently in progress to evaluate the scales' long-term stability and ability to predict such criteria as job satisfaction should be completed (page 17).

CONTENTS

	Page
Summary	v
BACKGROUND AND PURPOSE	1
PROCEDURE	
Instrument	3
Lambda Scale Construction	4
Preliminary Psychometric Characteristics of the Lambda Scales	7
Intercorrelations	7
Standard errors of measurement	8
Analysis of incomplete answer sheets	8
Development of a Verification Scale for the NVII	9
RESULTS AND DISCUSSION	
Preliminary Psychometric Characteristics of the Lambda Scales	10
Scale intercorrelations	10
Standard errors of measurement	10
Analysis of incomplete answer sheets	13
Verification Scale	14
SUMMARY AND CONCLUSIONS	15
RECOMMENDATIONS AND FUTURE RESEARCH PLANS	17
References	18
APPENDIX A	
Navy Vocational Interest Inventory	19
APPENDIX B	
Lambda Scale Methodology, Derivation of a Computing Formula for Lambda, and Sample Lambda Computation	27

TABLES

Page

1. Response Percentages of First and Second Term Enlistees in Each Rating Regarding Typicality of Their Work and Their Job Satisfaction 6

2. Number of Men in the Lambda Criterion Group for Each Rating 7

3. Intercorrelations, Means, and Standard Deviations of 1,055 Recruits-in-General on 15 Lambda Scales 11

4. Distribution of Standard Errors of Measurement (SE_M) Across 15 Lambda Scales of the NVII for 528 Recruits 12

5. Frequency Distributions of Intra-Individual Correlations Between Lambda Scale Profiles Based on First Part of NVII Items and Profiles Based on All 190 Items (N=100) 13

6. Percentage of Overlap Between Actual and Theoretical Chance Distributions of Scores for Each Experimental Verification Scale (N=527) 14

FIGURES

1. Scatter plot of highest lambda score against 11% verification scale score for 200 men tested under standard conditions and 130 men who completed answer sheets without access to the NVII items 16

OCCUPATIONAL SCALES OF THE NAVY VOCATIONAL INTEREST INVENTORY: I. DEVELOPMENT

BACKGROUND AND PURPOSE

The Navy Vocational Interest Inventory (NVII) is an interest questionnaire developed by Clark (1961) to help guide Navy enlisted men into ratings which are consistent with their vocational preferences and in which they are likely to experience job satisfaction.

Applying the empirically-established principle (Strong, 1943) that men with similar interests tend to find the same types of work most satisfying, Clark built 19 Navy occupational scales for the NVII to compare a man's interests with the interests of men in each of 19 ratings. He also developed nine homogeneous scales to indicate an individual's interest in general areas such as mechanics, electronics, and food service.

More recently, research has been undertaken to evaluate the NVII for possible use in recruit classification. In several studies, both the occupational and homogeneous scales were found to differentiate well among men in different Navy class "A" schools (Abrahams, Lau, & Neumann, 1968; Lau & Abrahams, 1969) and to predict such criteria as "A" school achievement (Abrahams, Lau, & Neumann, 1968) and reenlistment (Lau, Lacey, & Abrahams, 1969). Substantial test-retest reliabilities over

---

Abrahams, N. M., Lau, A. W., & Neumann, I. An analysis of the Navy Vocational Interest Inventory as a predictor of school performance and rating assignment. San Diego: U. S. Naval Personnel Research Activity, October 1968. (Research Report SRR 69-11)

Clark, K. E. The vocational interests of nonprofessional men. Minneapolis: University of Minnesota Press, 1961.

Lau, A. W., Lacey, L. A., & Abrahams, N. M. An analysis of the Navy Vocational Interest Inventory as a predictor of career motivation. San Diego: U. S. Naval Personnel Research Activity, June 1969. (Research Report SRR 69-27)

Lau, A. W., & Abrahams, N. M. Area scales of the Navy Vocational Interest Inventory as predictors of school performance and rating assignment. San Diego: U. S. Naval Personnel Research Activity, July 1969. (Research Report SRR 70-1)

Strong, E. K. Vocational interests of men and women. Stanford University Press, Stanford, 1943.

four to six years were also shown for reenlistees (Lau & Abrahams, 1970) and nonreenlistees (Lau & Abrahams, 1971).

Based upon these favorable results, a large-scale effort was undertaken in 1971 to update the NVII scales using more current samples of Navy men and a newer method of scale construction. The newer scale construction technique, known as the lambda method, was developed by Clemans (1958) and differs from the more traditional men-in-general method (Strong, 1943) in several ways:

The men-in-general method contrasts the interest inventory responses of members of an occupational group with responses of a general reference group, with an individual's score reflecting the extent to which he differs from the reference group in the same way as do members of the occupation. By contrast, Clemans' lambda scale construction technique provides scores (lambda coefficients) based upon a direct correlation between an individual's inventory responses and those of members of an occupation. Since a general reference group is not required for scale construction, scores derived from the new method are not affected by the composition of such a group. Further, the scores should theoretically be less affected than men-in-general type scores by an individual's failure to complete all items of the inventory. This could be advantageous for the Navy, since the NVII must occasionally be administered under time constraints which do not permit all individuals to completely answer the inventory. The lambda method may also result in fewer errors of classification than the men-in-general method, as indicated by Kuder's (1968) promising results with his Occupational Interest Survey.

Using Clemans' lambda scale-construction method, occupational scales were constructed for the NVII to compare an individual's interests with the interests of men in 15 diverse Navy ratings.

Clemans, W. V. An index of item-criterion relationship. Educational and Psychological Measurement, 1958, 18, 167-172.

Kuder, G. F. Kuder Occupational Interest Survey general manual. Chicago: Science Research Associates, Inc., 1968.

Lau, A. W., & Abrahams, N. M. The stability of scores on the Navy Vocational Interest Inventory. San Diego: Naval Personnel and Training Research Laboratory, March 1970. (Research Report SRR 70-17)

Lau, A. W., & Abrahams, N. M. Reliability and predictive validity of the Navy Vocational Interest Inventory. San Diego: Naval Personnel and Training Research Laboratory, February 1971. (Research Report SRR 71-16)

In interpreting scores on these scales, an index indicating whether or not an individual has responded to the inventory in a careful, conscientious manner is useful. Accordingly, five experimental verification scales were constructed using NVII items seldom endorsed by individuals completing the NVII under normal testing conditions. An individual selecting a substantial number of these low-frequency items probably did not complete the inventory properly for some reason such as carelessness or inability to understand the directions.

Based on these considerations, the present report will:

(1) Describe the development of 15 lambda occupational scales for the NVII;

(2) present information on the scales' intercorrelations and standard errors of measurement and on correlations between scores based on part of the items and scores based on all of the inventory items. These correlations should indicate whether incomplete answer sheets can be utilized;

(3) describe the development and evaluation of verification scales for the NVII.

PROCEDURE

Instrument

The NVII contains 190 items, each made up of three short descriptions of tasks or activities performed in a wide variety of Navy ratings.[1] An individual indicates his preference for the tasks in each item by choosing the one activity he likes best and the one he likes least. For example, one item on the NVII includes these tasks:

	Like		Dislike
a. Install a telephone.	●	a	Ⓓ
b. Make a written report of a month's work.	Ⓛ	b	Ⓓ
c. Draw a detailed terrain map.	Ⓛ	c	●

An individual might respond as shown above, indicating that he liked activity "a" best and activity "c" least, or he might choose some other combination of the three alternatives.

---

[1] A complete NVII booklet is provided in Appendix A.

Lambda Scale Construction

There were several important considerations in selecting the ratings for which lambda scales would be constructed:

1. Only a limited number of ratings were to be used, so wide applicability of the results depended upon the representativeness of these ratings. That is, ratings in mechanical, medical, and other general areas should be represented.

2. The ratings selected from each general interest area should be relatively large to provide sufficient data for scale development and evaluation. In addition, ratings with manpower shortages as indicated by low retention rates and high variable reenlistment bonuses were preferred, since it is especially important to identify individuals with interests appropriate to these ratings to meet the Navy's manning requirements.

3. At least several ratings which were highly similar to each other should be included so that the lambda scales' ability to differentiate among closely related, as well as highly diverse, ratings could be ascertained.

Based on these criteria, the following ratings were selected:

Air Controlman (AC)
Aviation Electrician's Mate (AE)
Aviation Ordnanceman (AO)
Boiler Technician (BT)
Commissaryman (CS)
Data Processing Technician (DP)
Electrician's Mate (EM)
Electronics Technician (ET)
Engineman (EN)
Equipment Operator (EO)
Hospital Corpsman (HM)
Quartermaster (QM)
Radioman (RM)
Sonar Technician (ST)
Storekeeper (SK)

In choosing the specific individuals from these ratings to include in the criterion groups for scale construction, three further guidelines were applied:

1. The individual should be relatively experienced in the work of his rating.

2. He should be engaged in work typical for his rating.

3. He should be satisfied with that work.

Using these guidelines, NVIIs were mailed in 1971 to male regular Navy personnel in each of the 15 selected ratings who were nearing the end of their first enlistment or beginning their second enlistment

(and who were thus relatively experienced in their work). Each individual was asked to indicate whether he was doing work typical for his rating and his degree of job satisfaction by answering the following questions:

Typical work

Which of the following statements is more true of the work you have been doing in the Navy?

(1) My work is like that of most other men in my rating (for example, a shipfitter who does welding and soldering, pipefitting, and similar tasks).

(2) My work is different from that of most other men in my rating (for example, a shipfitter who does recruiting for the Navy).

Job satisfaction

If you could start over again and choose any Navy rating you wanted, what would you do?

(1) I would choose my present rating.

(2) I would choose a different rating, but it would be in the same general area (i.e., mechanical, clerical, medical, etc.) as my present rating.

(3) I would choose a different rating in a completely different area from my present rating.

Response distributions on the typical work and job satisfaction questions for men returning completed NVIIs are shown in Table 1 and indicate a large proportion of men in some ratings who would choose a rating other than their own. Parenthetically, this finding suggests the need for improvements in recruit counseling and classification.

When these individuals who would choose another rating and individuals doing atypical work were eliminated, the rating criterion group sizes shown in Table 2 remained.[2]

To construct lambda scales for the NVII, the proportion of each rating criterion group endorsing each of the NVII's 1,140 possible

---

[2]Because only a limited sample of Boiler Technicians was obtained, men in this rating who indicated that they would choose a similar rating were included in the criterion group for scale construction.

TABLE 1

Response Percentages of First and Second Term Enlistees in Each Rating Regarding Typicality of Their Work and Their Job Satisfaction

Typicality of Work

First term enlistees[a]				Second term enlistees[a]			
Rating	Sample size	% doing typical work	% doing atypical work	Rating	Sample size	% doing typical work	% doing atypical work
AC	438	91	8	AC	271	92	8
AE	437	85	14	AE	284	87	10
AO	443	78	20	AO	326	78	21
BT	407	87	10	BT	217	87	9
CS	468	78	17	CS	272	76	18
DP	513	84	15	DP	289	81	19
EM	425	87	11	EM	218	85	14
EN	314	82	16	EN	262	80	17
EO	277	81	18	EO	181	74	24
ET	444	86	14	ET	260	89	10
HM	410	68	29	HM	292	76	21
QM	420	88	10	QM	265	61	35
RM	411	84	15	RM	274	89	9
SK	380	79	19	SK	260	78	18
ST	401	86	14	ST	261	85	15

Job Satisfaction

First term enlistees[a]					Second term enlistees[a]				
Rating	Sample size	% choose same rating	% choose same general area	% choose completely different area	Rating	Sample size	% choose same rating	% choose same general area	% choose completely different area
AC	438	84	3	11	AC	271	79	5	15
AE	437	43	35	19	AE	284	51	34	13
AO	443	19	24	54	AO	326	35	27	37
BT	407	13	41	43	BT	217	24	35	37
CS	468	39	10	49	CS	272	43	11	43
DP	513	83	7	10	DP	289	78	9	13
EM	425	36	35	27	EM	218	39	42	18
EN	314	38	35	25	EN	262	48	29	18
EO	277	74	10	14	EO	181	69	13	17
ET	444	56	25	18	ET	260	65	25	9
HM	410	67	12	19	HM	292	74	8	16
QM	420	33	14	52	QM	265	47	12	38
RM	411	27	39	33	RM	274	42	37	20
SK	380	31	33	35	SK	260	41	25	31
ST	401	29	43	28	ST	261	45	33	21

Note.--

[a]The sum of the response percentages for the different alternatives may total slightly less than 100 per cent because individuals with missing data have been omitted from the table.

TABLE 2

Number of Men in the Lambda Criterion Group for Each Rating

Rating	Size of Criterion Group: First term enlistees	Second term enlistees	Total
Air Controlman	342	194	536
Aviation Electrician's Mate	171	129	300
Aviation Ordnanceman	65	93	158
Boiler Technician	50	116	166
Commissaryman	148	92	240
Data Processing Technician	357	179	536
Electrician's Mate	141	76	217
Electronics Technician	210	150	360
Engineman	103	103	206
Equipment Operator	178	96	274
Hospital Corpsman	203	169	372
Quartermaster	129	83	212
Radioman	99	105	204
Sonar Technician	104	102	206
Storekeeper	99	83	182

response alternatives (i.e., one "like" and one "dislike" alternative for each of the three tasks comprising each of the NVII's 190 items) was determined.

These proportions for each rating criterion group were used to compute a point-biserial correlation between the individual's responses and those of the criterion group. The correlation was divided by the maximum like-signed point-biserial correlation which the individual could have attained with the criterion group, and a positive or negative sign was affixed to the result according to the sign of the individual's actual correlation with the criterion group. The resulting lambda scores may assume values between -1.00 and 1.00. (See Appendix B for a detailed discussion of lambda scores.)

Preliminary Psychometric Characteristics of the Lambda Scales

Intercorrelations. To determine intercorrelations of the lambda scales of the NVII, a sample of 1,055 recruits was randomly selected

from among 10,555 men administered the NVII at the Naval Training Center, San Diego, over a three month period in 1969.

Standard errors of measurement. At least two methods of estimating the standard error of measurement (SE_M) for lambda scales of the NVII could be used: An estimate could be determined separately for each scale across a number of individuals, or an estimate could be determined for each individual across all 15 scales and some measure of central tendency calculated. The latter method was considered more appropriate for the lambda scales of the NVII because lambda scores are intended only for intra-individual interpretation. No attempt has been made to standardize scores in relation to those of some criterion group or groups or to designate in absolute terms what constitutes a "high score." It is thus important to know the degree of measurement error which can be expected for the typical individual.

To estimate the reliability of the lambda scores for use in computing the standard error of measurement, the odd-even method was used. A sample of 528 recruits randomly selected from among 10,555 tested at the Naval Training Center, San Diego, in 1969, was scored once using only the odd-numbered items of the NVII and a second time using only the even-numbered items. An estimate of internal-consistency reliability was then obtained for each individual across the 15 scales by correlating scores based on the odd items with scores based on the even items. Using this reliability estimate, a standard error of measurement was determined for each individual.

Analysis of incomplete answer sheets. When the NVII is administered under time constraints, as may occasionally be necessary in the Navy, some individuals may fail to complete all items of the inventory. Unless these individuals' NVIIs can be scored to yield valid results, the time spent in completing them will be wasted.

The lambda method has an advantage over many scoring systems in coping with this problem in that, theoretically, scores based upon it should be less affected by missing responses and should yield usable scores over a widely varying number of items. If this assumption is confirmed empirically, the scoring of incomplete answer sheets would appear warranted, since such answer sheets would lead to approximately the same recommendations for the individual as complete ones. Construction of a shortened version of the NVII might also be feasible, although reliability and other relevant characteristics of lambda scales based upon such a version should be evaluated.

To determine the effect of missing responses on lambda scores, lambda scores were computed using the first 50%, 60%, 70%, 80%, and 90% of the NVII items, respectively, for 100 men randomly selected from among 10,555 tested at the Naval Training Center, San Diego, in 1969. The 15 scores on each profile were then rank-ordered, and intra-individual correlations were obtained between scores based on 50% of the items and scores based

on all 190 items using Spearman's Rank Difference Correlation method. Similar correlations were determined for scores based on all of the items versus those based on 60%, 70%, 80%, and 90% of the items, respectively.

Development of a Verification Scale for the NVII

If an individual completes his NVII carelessly, misunderstands the test instructions, or presents some similar problem, he will probably select certain unusual NVII responses more often than would a group of carefully responding individuals. Applying this principle to the construction of NVII verification scales which could be used to detect improperly completed answer sheets, responses were identified which were infrequently endorsed by 528 recruits completing the NVII under standard testing conditions. (These recruits were randomly selected from among 10,555 administered the NVII in 1969.) Five scales were formed by unit-weighting items endorsed by fewer than 7%, 8%, 9%, 10%, and 11%, respectively, of this group.[3]

To compare these scales with each other, 527 additional recruits from among the 10,555 were scored on all five scales, and distributions of their scores were obtained. A theoretical chance distribution of scores based upon the binomial distribution[4] was also determined for each scale to permit evaluation of the scales' ability to differentiate between presumably properly completed NVIIs and what should resemble carelessly completed NVIIs. The scale showing the least overlap between the real and chance distributions was then compared with a method of eliminating invalid profiles using only the magnitude of the individual's highest lambda score. If an individual had no high scores and hence few interests in common with men in any of the 15 diverse NVII profile ratings, he had probably encountered some difficulty in completing his NVII answer sheet. If the highest lambda score alone could identify invalid profiles as effectively as the best verification scale, the latter would be superfluous.

This second comparison was made by evaluating the two methods' ability to differentiate between recruits who completed the NVII properly and recruits who completed NVII answer sheets without access to the NVII items. The normally responding recruits consisted of 200 men randomly selected

---

[3] These values were selected because they yielded a reasonable number of items (13 for the 7% scale up to 56 for the 11% scale), while still being classifiable as infrequent responses.

[4] In determining the theoretical chance distribution for each scale, p was the probability of selecting one of the three response alternatives to an item (i.e., 1/3), q was 2/3, and n was the number of items comprising the scale.

from among 10,555 administered the NVII at the Naval Training Center, San Diego, in 1969, under standard testing conditions. The more randomly responding recruits consisted of 130 men given NVII answer sheets but no NVII questionnaire booklets and instructed to select one "like" and one "dislike" response for each NVII item. Responses of this group should approximate responses of carelessly responding recruits or recruits who did not understand the test instructions.

RESULTS AND DISCUSSION

Preliminary Psychometric Characteristics of the Lambda Scales

Scale intercorrelations. Table 3 shows intercorrelations among the 15 lambda scales of the NVII.

These correlations were generally higher than those reported by Kuder (1968) for his Occupational Interest Survey, probably because Kuder based his correlations upon 30 "core groups" selected for their diversity and representativeness of the different types of occupations on his profile. While some of the ratings used for lambda scale construction with the NVII were also chosen for their diversity, others were selected specifically for their similarity to each other. These similar ratings would be expected to show high intercorrelations.

The lambda NVII intercorrelations also tended to be higher than those obtained for the Strong Vocational Interest Blank (SVIB) (Campbell, 1971), largely because the men-in-general method used in constructing SVIB scales isolates those interests unique to a particular occupation, while the lambda method also includes interests which men in that occupation share with men-in-general.

The extremely high correlations (i.e., .99, .98) between several of the NVII scales may also indicate that a single scale, rather than two separate scales, would suffice for those ratings. However, lambda scales will soon be constructed for a large number of additional ratings, and any combination or elimination of scales will be accomplished after these new scales have been completed.

Standard errors of measurement. Table 4 shows a distribution of standard errors of measurement (SE_M) for 528 Navy recruits and indicates a median SE_M of .027.

Campbell, D. P. Handbook for the Strong Vocational Interest Blank. Stanford University Press, Stanford, 1971.

TABLE 3

Intercorrelations, Means, and Standard Deviations of 1,055 Recruits-in-General on 15 Lambda Scales

Scale	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	$\bar{X}$	S.D.
(1) Quartermaster		.89	.88	.91	.88	.14	.66	.77	.78	.82	.80	.85	.99	.85	.33	.35	.15
(2) Sonar Technician	.89		.99	.95	.81	-.12	.63	.93	.93	.97	.92	.95	.91	.99	.14	.36	.22
(3) Electronics Technician	.88	.99		.94	.80	-.16	.60	.91	.92	.97	.91	.94	.90	.98	.15	.34	.23
(4) Radioman	.91	.95	.94		.91	.13	.58	.86	.88	.92	.86	.90	.92	.94	.07	.36	.18
(5) Data Processing Technician	.88	.81	.80	.91		.44	.56	.72	.74	.77	.73	.78	.87	.79	.12	.31	.14
(6) Storekeeper	.14	-.12	-.16	.13	.44		.09	-.12	-.10	-.13	-.09	-.07	.08	-.13	-.14	.21	.14
(7) Commissaryman	.66	.63	.60	.58	.56	.09		.70	.68	.66	.75	.74	.67	.65	.12	.29	.14
(8) Engineman	.77	.93	.91	.86	.72	-.12	.70		.99	.98	.99	.99	.78	.97	-.12	.34	.27
(9) Boiler Technician	.78	.93	.92	.88	.74	-.10	.68	.99		.99	.99	.99	.79	.97	-.12	.34	.27
(10) Electrician's Mate	.82	.97	.97	.92	.77	-.13	.66	.98	.99		.97	.98	.83	.99	-.03	.35	.25
(11) Equipment Operator	.80	.92	.91	.86	.73	-.09	.75	.99	.99	.97		.99	.81	.96	-.08	.35	.25
(12) Aviation Ordnanceman	.85	.95	.94	.90	.78	-.07	.74	.99	.99	.98	.99		.86	.98	-.03	.36	.23
(13) Air Controlman	.99	.91	.90	.92	.87	.08	.67	.78	.79	.83	.81	.86		.87	.34	.35	.16
(14) Aviation Electrician's Mate	.85	.99	.98	.94	.79	-.13	.65	.97	.97	.99	.96	.98	.87		.04	.35	.24
(15) Hospital Corpsman	.33	.14	.15	.07	.12	-.14	.12	-.12	-.12	-.03	-.08	-.03	.34	.04		.17	.17

TABLE 4

Distribution of Standard Errors of Measurement (SE_M) Across 15 Lambda Scales of the NVII For 528 Recruits

SE_M	N	Cumulative percentage	SE_M	N	Cumulative percentage
.010	3	.005	.046	3	.939
.011	2	.009	.047	3	.945
.012	8	.024	.048	3	.950
.013	9	.041	.049	2	.954
.014	7	.054	.050	4	.962
.015	7	.068	.051	1	.964
.016	14	.094	.052	3	.969
.017	21	.134	.053	2	.973
.018	13	.159	.054	2	.977
.019	11	.179	.055	1	.979
.020	28	.232	.056	3	.984
.021	17	.265	.057	0	.984
.022	27	.316	.058	1	.986
.023	20	.354	.059	0	.986
.024	18	.388	.060	0	.986
.025	22	.429	.061	0	.986
.026	19	.465	.062	1	.988
.027	19	.501	.063	0	.988
.028	24	.547	.064	1	.990
.029	25	.594	.065	0	.990
.030	22	.636	.066	1	.992
.031	21	.676	.067	2	.996
.032	15	.704	.068	0	.996
.033	7	.717	.069	0	.996
.034	19	.753	.070	0	.996
.035	9	.770	.071	0	.996
.036	9	.787	.072	0	.996
.037	12	.810	.073	0	.996
.038	13	.835	.074	0	.996
.039	7	.848	.075	0	.996
.040	12	.871	.076	0	.996
.041	11	.892	.077	1	.998
.042	12	.914	.078	0	.998
.043	2	.918	.079	0	.998
.044	3	.924	.080	0	.998
.045	5	.933	.081	1	1.000

Median SE_M = .027

Based upon this median, a one per cent confidence interval, and a two-tailed t test, a difference of .07 or more between two lambda scores can be considered a true difference. Based upon a one per cent confidence interval and a one-tailed t test, scores at least .06 points from an individual's highest score can be considered different from that score.

Analysis of incomplete answer sheets. Table 5 shows distributions of intra-individual rank-difference correlations between scores based on part and those based on all of the NVII items.

The median correlations were in all cases very high, ranging from .96 for scores derived from 50 per cent of the items, to .99 for scores derived from 90 per cent of them.

TABLE 5

Frequency Distributions of Intra-Individual Correlations Between Lambda Scale Profiles Based on First Part of NVII Items and Profiles Based on All 190 Items (N=100)

Spearman's Rank Difference Correlation	Portion of NVII items on which scores correlated with total-item profiles were based				
	50% of items	60% of items	70% of items	80% of items	90% of items
.10 or less					
.11 - .20					
.21 - .30					
.31 - .40					
.41 - .50	1				
.51 - .60	1	1			
.61 - .70	1	1	2		
.71 - .80	1	2	1	3	
.81 - .90	14	9	5	2	1
.91 - .95	19	23	23	16	1
.96 -1.00	63	64	69	79	98
Median Correlation	.96	.97	.97	.99	.99

Based on these correlations, NVII answer sheets with as few as 50 per cent of the items completed can be scored with confidence. The correlations also indicate the possibility of constructing a considerably shortened version of the NVII.

Verification Scale

Table 6 shows the percentage of overlap between the actual and theoretical chance distributions of scores among 527 recruits not used in verification scale development for each of the five experimental verification scales.

TABLE 6

Percentage of Overlap[a] Between Actual and Theoretical Chance Distributions of Scores for Each Experimental Verification Scale (N=527)

Scale	$\frac{M_1 - M_2}{\frac{\sigma_1 + \sigma_2}{2}}$	Percentage of overlap
7 per cent	2.48	22
8 per cent	3.02	13
9 per cent	3.26	10
10 per cent	3.58	7
11 per cent	3.60	7

Note.--

[a]For a discussion of percentage of overlap, see Tilton, 1937.

Tilton, J. W. The measurement of overlapping. Journal of Educational Psychology, 1937, 28, 656-662.

As the percentages indicate, the 11% verification scale resulted in the least overlap between the two distributions. This scale was therefore selected for comparison with the method of detecting invalid profiles based upon the magnitude of an individual's highest lambda score.

To make this second comparison, a scatter plot of highest lambda scores against scores on the 11% verification scale was made for 200 of the 527 recruits. A similar plot was made for 130 recruits who completed NVII answer sheets without access to the NVII items. This plot is shown in Figure 1.

Using only the highest lambda score to discriminate between the normal and random respondents, a minimum of one misclassification for the 330 individuals plotted could be achieved at a lambda cutting score of .15, .16, or .17. Using only the verification scale, a minimum of 12 misclassifications would result at a verification scale cutting score of 11 or 12.[5]

Based on these results, the method of eliminating invalid profiles using the magnitude of the highest lambda score was considered superior to using scores on any of the five verification scales constructed. In practice, only NVII profiles with lambda scores above .15 should be used, since they are probably based upon carefully and correctly completed answer sheets. Profiles with no scores above .25 should be used only with caution. These values were selected somewhat arbitrarily, but misclassify approximately one per cent and five per cent, respectively, of legitimate respondents.

SUMMARY AND CONCLUSIONS

Using samples of first and second term enlistees and Clemans' lambda method of scale construction, NVII scales were formed to compare an individual's interests with the interests of men in the following 15 ratings: Air Controlman (AC), Aviation Electrician's Mate (AE), Aviation Ordnanceman (AO), Boiler Technician (BT), Commissaryman (CS), Data Processing Technician (DP), Electrician's Mate (EM), Electronics Technician (ET), Engineman (EN), Equipment Operator (EO), Hospital Corpsman (HM), Quartermaster (QM), Radioman (RM), Sonar Technician (ST), and Storekeeper (SK).

Intercorrelations among these scales were determined and ranged from -.16 to .99--generally higher than intercorrelations reported for the Kuder Occupational Interest Survey or the Strong Vocational Interest Blank.

---

[5] It is possible that several of the presumably legitimate respondents misclassified using these cut-offs actually completed their answer sheets carelessly.

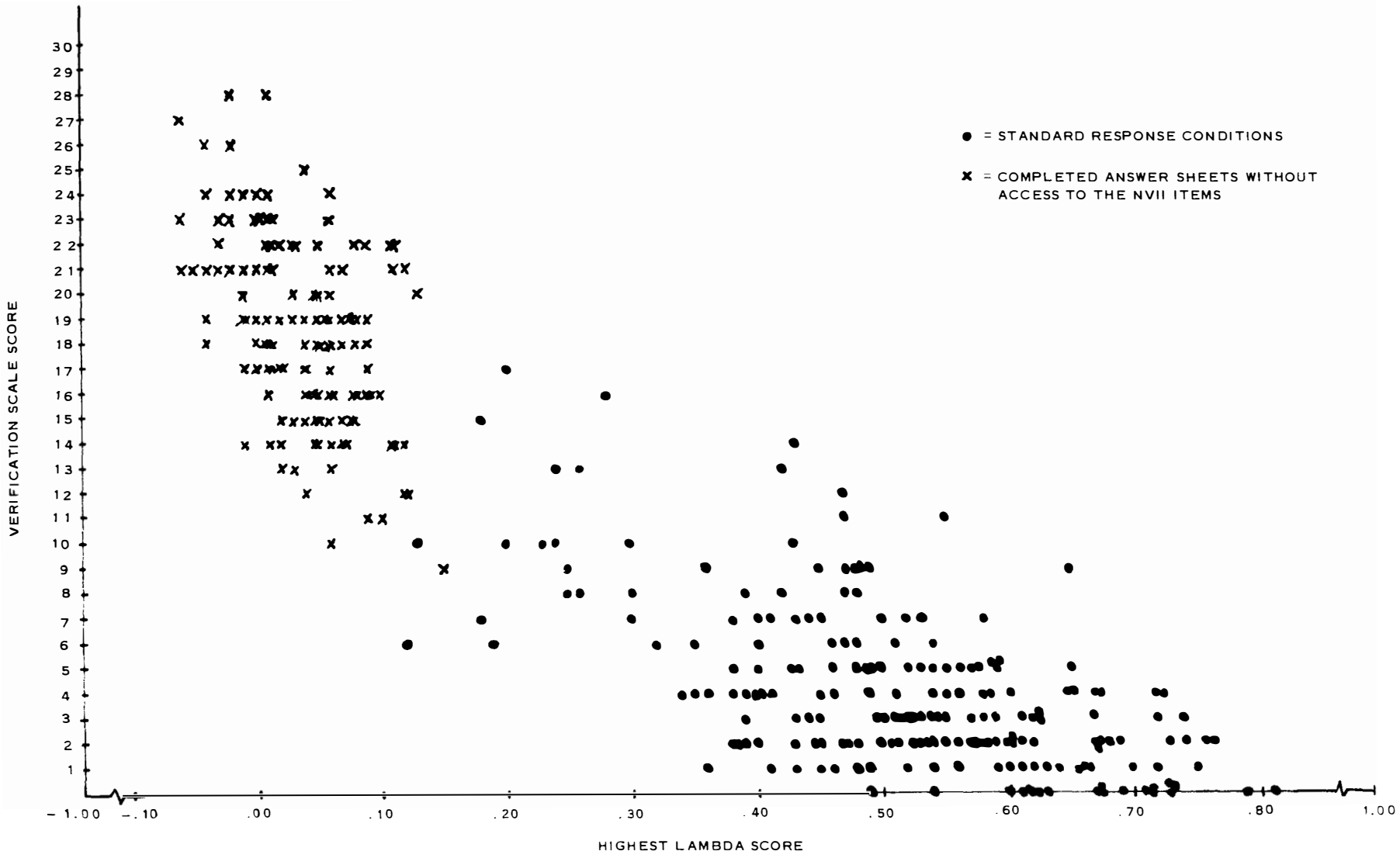


Fig. 1. Scatter plot of highest lambda score against 11% verification scale score for 200 men tested under standard conditions and 130 men who completed answer sheets without access to the NVII items.

The median intra-individual standard error of measurement across the 15 scales for 528 recruits was .027. Based on this median, a one per cent confidence interval and a two-tailed t test, a difference of .07 or more between two scores could be considered a true difference.

When lambda score profiles based on the first 50%, 60%, 70%, 80%, and 90% of the NVII items were correlated for each individual with scores based on all of the NVII items, the median correlations ranged from .96 for 50% of the items to .99 for 90% of them.

Of five experimental verification scales which were constructed to identify lambda score profiles derived from careless or otherwise faulty responses, none detected invalid profiles as effectively as considering only the magnitude of the individual's highest lambda score.

Based upon these results, the following conclusions appear warranted:

1. A difference of .07 or more between two lambda scores can be regarded as a true difference in light of the median intra-individual standard error of measurement. Scores .06 or more points below the highest lambda score can be considered different from that score.

2. Legitimate lambda score profiles can be obtained for individuals who, because of time constraints or similar reasons, complete as few as 50 per cent of the NVII items.

3. Incorrectly or carelessly completed NVII answer sheets are more accurately identified using the magnitude of an individual's highest lambda score than using the magnitude of his score on any of the five experimental verification scales which were constructed. In operational practice, no NVII profiles having all scores below .15 should be used, since such profiles are probably based upon poorly completed answer sheets. Profiles with no scores above .25 should be used only with caution.

RECOMMENDATIONS AND FUTURE RESEARCH PLANS

In general, the lambda occupational scales of the NVII appear promising for use in guiding individuals into appropriate Navy ratings and will probably be recommended for such use in the near future. However, before implementation is advised, the scales should demonstrate long-term stability and various types of validity. For instance, men in different ratings and satisfied and dissatisfied men within the same rating should be discriminable from each other. In general, vocational decisions made using the lambda scales should be of higher quality than those achieved under the present system.

Research currently in progress will permit such evaluation of the lambda scales.

REFERENCES

Abrahams, N. M., Lau, A. W., & Neumann, I. An analysis of the Navy Vocational Interest Inventory as a predictor of school performance and rating assignment. San Diego: U. S. Naval Personnel Research Activity, October 1968. (Research Report SRR 69-11)

Campbell, D. P. Handbook for the Strong Vocational Interest Blank. Stanford University Press, Stanford, 1971.

Clark, K. E. The vocational interests of nonprofessional men. Minneapolis: University of Minnesota Press, 1961.

Clemans, W. V. An index of item-criterion relationship. Educational and Psychological Measurement, 1958, 18, 167-172.

Kuder, G. F. Kuder Occupational Interest Survey general manual. Chicago: Science Research Associates, Inc., 1968.

Lau, A. W., & Abrahams, N. M. Area scales of the Navy Vocational Interest Inventory as predictors of school performance and rating assignment. San Diego: U. S. Naval Personnel Research Activity, July 1969. (Research Report SRR 70-1)

Lau, A. W., & Abrahams, N. M. The stability of scores on the Navy Vocational Interest Inventory. San Diego: Naval Personnel and Training Research Laboratory, March 1970. (Research Report SRR 70-17)

Lau, A. W., & Abrahams, N. M. Reliability and predictive validity of the Navy Vocational Interest Inventory. San Diego: Naval Personnel and Training Research Laboratory, February 1971. (Research Report SRR 71-16)

Lau, A. W., Lacey, L. A., & Abrahams, N. M. An analysis of the Navy Vocational Interest Inventory as a predictor of career motivation. San Diego: U. S. Naval Personnel Research Activity, June 1969. (Research Report SRR 69-27)

Strong, E. K. Vocational interests of men and women. Stanford University Press, Stanford, 1943.

Tilton, J. W. The measurement of overlapping. Journal of Educational Psychology, 1937, 28, 656-662.

APPENDIX A

NAVY VOCATIONAL INTEREST INVENTORY

The purpose of this test is to show whether you would like or dislike the work in each of several Navy rates. This is a test of interests, not a test of intelligence or ability. It indicates the degree to which your interests are like those of rated men in various Navy jobs.

Before beginning the test, you should complete the information on the front of the answer sheet as follows:

(1) Print your name--last name, first name, and middle initial--just under the words "NAVY VOCATIONAL INTEREST INVENTORY."

(2) On the line below your name, print the date--day, month, year. (e.g. 5 Jan 69)

(3) In the section to the right are several information areas with boxes and circles. In the boxes of the section headed "Name," print your last name. Then skip a box and print as much of your first name as possible. Below each box, blacken the circle that has the same letter as that box. Blacken the blank circle for the space.

(4) Fill in the sections for "Service Number" and "Year of Birth" in a similar way, completing the boxes and then blackening the correct circle beneath each box. Only the last two digits of your birth year should be used. For example, if you were born in 1944, the "Year of Birth" boxes should contain the number "44."

(5) Blacken the appropriate circle under "Sex."

(6) In the "Special Code Section," use the first three boxes (A, B, and C) to indicate your company number.

(7) Skip box D. In boxes E and F, print the number of years of formal education you have completed. (For example, if you finished the ninth grade, boxes E and F would contain the numbers "09.")

Now turn to the items of the test itself on the following pages.

There you will find many activities listed--they are arranged in groups of three. In each group, first read the three activities. Then choose the <u>one</u> activity that you would most like to do, and the <u>one</u> activity you would most dislike to do. You are to indicate your choices on the separate answer sheet. For the activity you like best, fill in the "L" circle on the answer sheet. For the activity you dislike most (or like the least), fill in the "D" circle. Leave the circle for the remaining activity blank. Remember, mark only <u>one</u> like and <u>one</u> dislike for each block of three items.

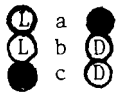
For example:

On the test booklet--

113. a. Play poker
b. Play basketball
c. Play checkers

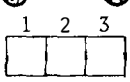
On the answer sheet--

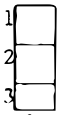
113.



These marks indicate that the activity, "Play checkers" is liked most, while "Play poker" is disliked most, or liked least. The other item is then left blank.

All responses must be thoroughly and completely blackened in with the soft lead pencils provided. Do <u>NOT</u> USE INK. Correct and incorrect ways of blackening the circles are shown below:

Notice also that items on the answer sheet are numbered <u>across</u> 

rather than down. 

There should be no stray marks anywhere on the answer sheet, including the margins. If you change your mind, erase the old mark completely. Answer all items, beginning with Item 1. When in doubt, make the best guess you can about what you like most and dislike most. Be sure to make <u>one</u> mark in the "L" column and <u>one</u> mark in the "D" column for each block of three items. DO NOT MAKE ANY MARKS ON THIS BOOKLET.

1. a. Catch up on your letter writing.
   b. Try to fix a kitchen clock.
   c. Discuss your philosophy of life with someone.

2. a. Type a letter for a friend.
   b. Play solitaire with playing cards.
   c. Take a broken lock apart to see what is wrong with it.

3. a. Solicit money for a community chest.
   b. Check typewritten material for errors.
   c. Install an electric meter box.

4. a. Tape a bruised ankle.
   b. Operate a bookkeeping machine.
   c. Solve mechanical puzzles.

5. a. Watch an appendicitis operation.
   b. Attend a lecture on television.
   c. Go to an exhibit of recent inventions.

6. a. String an aerial for a friend's radio.
   b. Try to win someone over to your side in an argument.
   c. Experiment with making candy without knowing the recipe.

7. a. Be an office manager.
   b. Be a bookkeeper.
   c. Be an artist.

8. a. Play a musical instrument.
   b. Play tennis.
   c. Work crossword puzzles.

9. a. Do clerical work.
   b. Cook short orders.
   c. Sew on buttons.

10. a. Write a newspaper column of advice on personal problems.
    b. Take part in an athletic tournament.
    c. Take part in a public speaking contest.

11. a. Work in a hospital.
    b. Work as night watchman at a military supply depot.
    c. Work in a textile (clothing) factory.

12. a. Study chemistry.
    b. Study stenography (secretarial training).
    c. Study manual training.

13. a. Make a model train.
    b. Repair a clock.
    c. Make a radio set.

14. a. Be the cashier in a bank.
    b. Be a radio announcer.
    c. Be an electrician.

15. a. Listen to recordings of a symphony concert.
    b. Play bridge (card game).
    c. Go to a track meet.

16. a. Repair electrical wiring.
    b. Fix a clogged drain.
    c. Check for errors in the copy of a report.

17. a. Work in the control room of a radio broadcasting studio.
    b. Work in a dental laboratory.
    c. Work at an information desk.

18. a. Be an electrical engineer.
    b. Be an aeronautical engineer (designs airplanes).
    c. Be a surgeon.

19. a. Perform laboratory experiments.
    b. Work with electrical devices.
    c. Make out shipping bills.

20. a. Operate a drill press.
    b. Be a cook in a restaurant.
    c. Take shorthand.

21. a. Send radio messages using code.
    b. Conduct research on the effects of drugs.
    c. Sell calculating machines.

22. a. Do scientific research.
    b. Write a novel.
    c. Repair watches.

23. a. Tinker with a broken sewing machine.
    b. Refinish an old piece of furniture.
    c. Make a study of mental ills.

24. a. Set type for a small newspaper.
    b. Inspect clothing for damage and flaws.
    c. Plan menus.

25. a. Work on developing synthetic rubber.
    b. Inspect machines to see if they are in good condition.
    c. Put together the parts of a calculating machine.

26. a. Study architectural design.
    b. Study sociology.
    c. Study calculus.

27. a. Be a machine operator.
    b. Be a bill collector.
    c. Work as a paper hanger.

28. a. Conduct research on improving airplane design.
    b. Work on the development of a lighter and stronger metal.
    c. Do an experiment to prove the earth is round.

29. a. Run an elevator.
    b. Be a filing clerk.
    c. Work in a laboratory where telescope lenses are made.

30. a. Leaf through an illustrated (picture) cook book.
    b. Do addition problems in your head.
    c. Practice hitting a punching bag.

31. a. Sell clothes in a men's store.
    b. Type letters.
    c. Operate a simple drill press.

32. a. Be a grocer.
    b. Be a printer.
    c. Be a shop foreman.

33. a. Make drawings for a newspaper.
    b. Check stock in a store room.
    c. Make small repairs around the home or garage.

34. a. Write letters.
    b. Fix a leaky faucet.
    c. Interview someone for a newspaper story.

35. a. Take a course in biology.
    b. Take a course in cost accounting.
    c. Take a course in engine design.

36. a. Operate a precision lathe.
    b. Overhaul an automobile engine.
    c. Make a chemical analysis of a new toothpaste.

37. a. Make a new key to replace a broken one.
    b. Add columns of figures.
    c. Install an electric light switch.

38. a. Be an interpreter of a foreign language.
    b. Be a railway conductor.
    c. Be a welder.

39. a. Varnish a floor.
    b. Learn to use a slide rule.
    c. Repair a broken connection on an electric iron.

40. a. Fix a doorbell.
    b. Make coffee.
    c. Sort mail.

41. a. Study touch typewriting.
    b. Study shop work.
    c. Study business arithmetic.

42. a. Put a closet in order.
    b. File cards in alphabetical order.
    c. Make a pie.

43. a. Be a master mechanic.
    b. Be a chemist.
    c. Be a recreation director.

44. a. Fill prescriptions in a drug store.
    b. Operate an addressing machine.
    c. Operate a printing press.

45. a. Tune a piano.
    b. Cook a meal.
    c. Change a tire on an automobile.

46. a. Install an electric light bulb socket.
    b. Look for errors in the draft of a report.
    c. Test water to see if it's pure.

47. a. Study blood smears under a microscope.
    b. Take shorthand.
    c. Make drawings of airplane parts.

48. a. Be a private secretary.
    b. Be an explorer.
    c. Be a radio equipment repair technician.

49. a. Study story writing.
    b. Study building construction.
    c. Study personnel administration.

50. a. Read gas meters.
    b. Put tags and labels on merchandise.
    c. Locate and replace shorted wires.

51. a. Study carpentry.
    b. Study first aid.
    c. Study welding.

52. a. Repair and refinish old furniture.
    b. Operate a cash register.
    c. Test radio tubes.

53. a. Be a fingerprint expert.
    b. Be a weather forecaster.
    c. Be an efficiency expert who improves shop procedure.

54. a. Set up the electrical equipment on a movie sound stage.
    b. Draw plans for a large bridge.
    c. Make a chemical analysis of a new product.

55. a. Rivet sheet metal.
    b. Solve physics problems.
    c. Read radio blueprints.

56. a. Build rowboats.
    b. Make novelty toys.
    c. Make linoleum block bookplates.

57. a. Be a mechanical engineer.
    b. Be an auto repairman.
    c. Be a machinist.

58. a. Be a salesman in a hardware store.
    b. Be a salesman for a real estate office.
    c. Be an insurance agent.

59. a. Set up your own photographic darkroom.
    b. Build furniture for the lawn of your home.
    c. Carve figures from wood.

60. a. Repair torn clothing.
    b. Wash and polish an automobile.
    c. Adjust a carburetor.

61. a. Be a concert musician.
    b. Be a photo engraver.
    c. Be a surveyor.

62. a. Make machine tools.
    b. Develop negatives in a photographic darkroom.
    c. Play records for an all night radio program.

63. a. Install electric switches.
    b. Operate an office adding machine.
    c. Drive a taxi.

64. a. Install a telephone.
    b. Make a written report of a month's work.
    c. Draw a detailed terrain map.

65. a. Take part in a debate.
    b. Have your fortune told.
    c. Play chess.

66. a. Teach mathematics.
    b. Help young people select their vocations.
    c. Do chemical research.

67. a. Work crossword puzzles.
    b. Work mental arithmetic problems.
    c. Show a friend how to operate a jigsaw.

68. a. Be a secret service man.
    b. Write a book on modern music.
    c. Make a study of flower arrangement.

69. a. Inspect food for spoilage.
    b. Wash dishes.
    c. Fix a flashlight that will not light.

70. a. Get a job selling chemical supplies.
    b. Get a job as a telephone lineman.
    c. Get a job as an office worker.

71. a. Direct the work of a construction gang.
    b. Sell office equipment.
    c. Plan musical programs.

72. a. Draw graphs and charts.
    b. Operate a mimeograph duplicating machine.
    c. Manage an office.

73. a. Learn to play golf.
    b. Learn to cook.
    c. Learn to use a news camera.

74. a. Take care of plants.
    b. Paint water colors.
    c. Help someone with his income tax.

75. a. Teach English.
    b. Teach chemistry.
    c. Teach arithmetic.

76. a. Transmit radio messages on voice circuits.
    b. Write a report.
    c. Adjust automobile brakes.

77. a. Inspect and repair an adding machine.
    b. Operate a steam clothes presser.
    c. Handle orders for supplies.

78. a. Putter around in a garden.
    b. Take part in an amateur contest.
    c. Cook spaghetti.

79. a. Repair damage to a tree after a storm.
    b. Construct a cabinet according to a blueprint.
    c. Install an electric buzzer system.

80. a. Check the spelling of a list of names.
    b. Patch a leaky roof.
    c. Help load boxes onto a truck.

81. a. Fix a wobbly table.
    b. Retouch negatives.
    c. Operate a moving picture camera.

82. a. Arrange a pile of letters in order of the date received.
    b. Scramble eggs.
    c. Pack food products for shipping.

83. a. Interview job applicants.
    b. Supervise the building of a bridge.
    c. Plan a radio program.

84. a. Write daily reports on the progress of a community chest drive.
    b. Make charts for use by ship companies or airlines.
    c. Help select equipment for a machine shop.

85. a. Conduct research on the psychology of music.
    b. Conduct research on the causes of earthquakes.
    c. Figure out new schemes to get work done rapidly and efficiently.

86. a. Be a court stenographer (secretary).
    b. Be a lathe operator.
    c. Be a vocational counselor.

87. a. Operate an office comptometer.
    b. Operate a power shovel.
    c. Operate a precision machine.

88. a. Freeze ice cream in a hand freezer.
    b. Check copies of reports to be sure they are correct.
    c. Check for breakage in a shipment of phonograph records.

89. a. Collect pipes.
    b. Collect phonograph records.
    c. Collect stamps.

90. a. Build a fire in a fireplace.
    b. Fix a noisy radiator.
    c. Make half quantity of a given recipe.

91. a. Have charge of the care and upkeep of a turret lathe.
    b. Help with work to improve the efficiency of artificial arms and legs.
    c. Help with research on television.

92. a. Hang a large wall mirror.
    b. Read aloud to someone.
    c. Take the initiative in settling an argument between two people.

93. a. Regulate a wrist watch.
    b. Translate a code message into words.
    c. Repair a broken zipper.

94. a. Be an office personnel manager.
    b. Be a skilled airplane mechanic.
    c. Be an animal doctor.

95. a. Make pottery dishes.
    b. Measure cloth by the yard.
    c. Splice wire together.

96. a. Record readings from weather forecasting instruments.
    b. Collect coins from parking meters and record receipts.
    c. Keep records of community chest pledges.

97. a. Draw a series of comic strips.
    b. Design an airplane.
    c. Build models of ships.

98. a. Drive a large truck.
    b. Put new pockets in clothes.
    c. Adjust front wheel bearings.

99. a. Address envelopes.
    b. Try to find an error in a financial account.
    c. Help put out the fire in a burning building.

100. a. Pack breakable articles for shipping.
     b. Inspect cloth for defects or damages.
     c. Operate a sewing machine.

101. a. Be a hospital attendant.
     b. Be a bank teller.
     c. Be a tool maker.

102. a. Take still life pictures.
     b. Take news photographs.
     c. Practice golf shots.

103. a. Spend an evening meeting new people at a social club.
     b. Spend an evening just chatting with a group of friends.
     c. Go to a hockey game.

104. a. Read the sports page of a newspaper.
     b. Read the editorial page of a newspaper.
     c. Read the financial page of a newspaper.

105. a. Wash clothes.
     b. Bind books.
     c. Take care of a lawn.

106. a. Do a lot of reading.
     b. Write letters on business matters.
     c. Look up new words in the dictionary.

107. a. Belong to an amateur astronomy club.
     b. Belong to a bowling club.
     c. Belong to a debate club.

108. a. Take a course in salesmanship.
     b. Take a course in business law.
     c. Take a course in mathematics.

109. a. Get a job in a factory.
     b. Get a job in a retail store.
     c. Go to school.

110. a. Help campaign for donations for an orphanage.
     b. Work in an office.
     c. Set up machines for a woodworking shop.

111. a. Raise poultry (chickens, ducks).
     b. Repair shoes.
     c. Press clothes.

112. a. Take a machine apart to see how it works.
     b. Assist a doctor at the scene of an accident.
     c. Teach someone how to use a machine.

113. a. Play poker.
     b. Play basketball.
     c. Play checkers.

114. a. Take part in an amateur show.
     b. Go on a canoe trip.
     c. Play pool.

115. a. Work in a factory.
     b. Work at a desk.
     c. Work outdoors.

116. a. Be introduced to a famous scientist.
     b. Be introduced to a well known movie star.
     c. Be introduced to a prominent politician.

117. a. Interview job applicants.
     b. Investigate the causes of mental ills.
     c. Try out different sails on a model sailboat to see which is best.

118. a. Write an arrangement of a popular song.
     b. Conduct a study of the causes of crime.
     c. Help a friend who is discouraged.

119. a. Go to a large party.
     b. Go to a small party.
     c. Spend the evening with a friend.

120. a. Read a biography of Louis Pasteur.
     b. Read an article on U. S. foreign relations.
     c. Read about the history of the drama.

121. a. Wait on table.
b. Operate a knitting machine.
c. Broil club steak.

122. a. Go to a dance.
b. Go to a birthday party.
c. Go to the movies.

123. a. Lead a community sing.
b. Write in a diary.
c. Do some sketching.

124. a. Read a book on psychology.
b. Read a detective story.
c. Read a current best seller.

125. a. Work behind a soda fountain.
b. Type letters from a dictation machine.
c. Check supplies received against a list of those ordered.

126. a. Learn to write a financial report.
b. Take a course in astronomy (study stars).
c. Take a course in public speaking.

127. a. Practice shooting with a rifle.
b. Read "Time" magazine.
c. Read "The Scientific Monthly."

128. a. Do woodcarving.
b. Collect phonograph records.
c. Keep a snapshot album.

129. a. Read detective stories.
b. Read book reviews in the newspaper.
c. Read the sports page in the newspaper.

130. a. Tell jokes to a group of friends.
b. Play a pinball machine.
c. Umpire a baseball game.

131. a. See a movie short about sports.
b. See a movie short about the FBI.
c. See a comedy movie short.

132. a. Be in charge of the tool room in a factory.
b. Be an office clerk.
c. Be a watchmaker.

133. a. Make furniture.
b. Work with leather.
c. Draw sketches of things or people around you.

134. a. Read about early musical forms.
b. Read about how an airplane is assembled.
c. Read an article about causes of disease.

135. a. Play poker.
b. Pitch horseshoes.
c. Go fishing.

136. a. Talk with an expert on engine design.
b. Talk with a well known newspaper writer.
c. Talk with a prominent doctor about his medical experiences.

137. a. Read about social customs in different countries.
b. Read a book about electronics design.
c. Read about the discovery of a new pain killing drug.

138. a. Take care of mental patients.
b. Assist in a chemical laboratory.
c. Operate an office duplicating machine.

139. a. Be a statistician.
b. Be a professional athlete.
c. Be a lawyer.

140. a. Sell typewriters.
b. Grind lenses for telescopes.
c. Draw the pictures for a magazine article.

141. a. Improve methods of reproducing pictures in color.
b. Work out a catalog system for books in a library.
c. Think up new time saving gadgets for use around the house.

142. a. Study care of the war-wounded.
b. Study accounting.
c. Study refrigeration and air conditioning.

143. a. Tailor men's clothes.
b. Read proof for a newspaper.
c. Inspect machinery for repair needs.

144. a. Assemble mechanical parts.
b. Fry liver and onions.
c. Sharpen machine drills.

145. a. Give "first aid" assistance.
b. Make deep sea dives.
c. Keep accounting machines in repair.

146. a. Write feature stories for a newspaper.
b. Read reviews of recent books.
c. Work in a medical laboratory.

147. a. Study shorthand.
b. Study engineering mathematics.
c. Study foreign languages.

148. a. Operate a calculating machine.
b. File records and circulars.
c. Send coded messages by radio.

149. a. Be a librarian.
b. Be a draftsman.
c. Be a salesman.

150. a. Repair radio equipment.
b. Build things from wood.
c. Sort mail in a post office.

151. a. Supervise men working on an assembly line.
b. Keep records for a doctor's office.
c. Build boats.

152. a. Play baseball.
b. See an educational movie.
c. Visit someone in the hospital.

153. a. Keep accounts.
b. Make maps.
c. Keep mailing lists.

154. a. Be a garage mechanic.
b. Be a professional musician.
c. Be a pharmacist.

155. a. Manage an office.
b. Repair a radio set.
c. Estimate the cost of manufacturing a new medicine.

156. a. Arrange music for an orchestra.
b. Take an inventory of supplies in a wholesale store.
c. Write an article for housewives on "How to Repair Household Appliances."

157. a. Decode messages written in code.
b. Do blood chemistry in a medical laboratory.
c. Assist in research on automobile design.

158. a. Take photographs of your friends.
b. Write a popular article on how a diesel engine works.
c. Plan a recreation schedule.

159. a. Be a draftsman.
b. Be a chef.
c. Be a physical therapist.

160. a. Study sheet metal pattern drafting.
b. Study machine computation.
c. Study physiology (how the body works).

161. a. Operate a steam shovel.
b. Run a gas station.
c. Drive an automobile.

162. a. Be a sculptor.
b. Be a photographer.
c. Be a test pilot.

163. a. Set up a bookkeeping system.
b. Take apart a mechanical toy to see how it works.
c. Experiment with a home recording set.

164. a. Make a statistical study for a business concern.
b. Write an article on how machine tools are made.
c. Do research on the cause of cancer.

165. a. Be a supply clerk.
b. Be a buyer of merchandise.
c. Be a laboratory technician.

166. a. Read a book on how to lead discussion groups.
b. Read a book about modern methods of bookkeeping.
c. Read about new uses for plastics.

167. a. Work in a laundry.
b. Develop better recipes for baked goods.
c. Reupholster an old davenport.

168. a. Listen to a talk about up-to-date shop appliances.
b. Listen to a talk on propaganda methods.
c. Listen to a talk on hospital procedure.

169. a. Be a food buyer in some large institution.
b. Manage an apartment building.
c. Run a service for people confused about their income taxes.

170. a. Go bowling with a friend.
b. Go to a movie by yourself.
c. Spend an evening with a crowd of friends.

171. a. Attend a lecture about experiments to improve airplane design.
b. Listen to a speech on current affairs.
c. See a famous ballet.

172. a. Be a physician.
b. Be a locomotive engineer.
c. Write novels.

173. a. Read about steel bridge design.
b. Read about systems in a modern office.
c. Read an article on new uses of X-Ray.

174. a. Train a dog.
b. Listen to jazz recordings.
c. Look at new airplane designs.

175. a. Study the color effects in a famous painting.
b. Study photographs of a surgical operation.
c. Study the instrument panel of a bomber.

176. a. Be an expert on color photography.
b. Be an athletic director.
c. Be a certified public accountant (CPA).

177. a. Give the ether during an emergency operation.
b. Work out new uses for old machine parts.
c. Keep accounts of money.

178. a. Take a blood sample.
b. Explain to someone how to fill out insurance forms.
c. Fix a faulty light switch.

179. a. Be a professor of a foreign language.
b. Be an architect.
c. Be a psychologist.

180. a. Manage a cafeteria.
b. Keep personnel records and reports.
c. Write articles on hobbies.

181. a. Sing in a chorus.
b. Read detective stories.
c. Attend a newsreel theatre.

182. a. Be a carpenter.
b. Be a telegraph operator.
c. Be a doctor's assistant.

183. a. Alphabetize cards.
b. Cut meat.
c. Varnish floors.

184. a. Mix pancake batter.
b. Install a hot water heater.
c. Take part in a military drill.

185. a. Go to a boxing match.
b. Go bicycling.
c. Go to a dance.

186. a. Be a professor of mathematics.
b. Be a writer.
c. Be a scientific research worker.

187. a. Spend an afternoon reading in the library.
b. Visit a famous medical research laboratory.
c. Visit famous art galleries.

188. a. Write the script for a radio program.
b. Talk before a group of people.
c. Take charge of a telephone switchboard.

189. a. Handle the advertising for a newspaper.
b. Keep business letters in alphabetical order.
c. Make mechanical drawings.

190. a. Be a publicity director for a large company.
b. Be a druggist.
c. Be a jeweler.

APPENDIX B

LAMBDA SCALE METHODOLOGY, DERIVATION OF A COMPUTING FORMULA FOR LAMBDA, AND SAMPLE LAMBDA COMPUTATION

Lambda Scale Methodology

To construct lambda scales for the NVII, the proportion of each rating criterion group endorsing each of the NVII's 1,140 possible response alternatives (i.e., one "like" and one "dislike" alternative for each of the three tasks comprising each of the NVII's 190 items) was determined.

These proportions were then used as follows to compute lambda scores for an individual: For each scale, the point-biserial correlation between the individual's responses and those of the criterion group (e.g., experienced, satisfied storekeepers) was determined. (The continuous variable in the point-biserial computation was the proportion of the criterion group making each response, and the dichotomous variable was the individual's selection or non-selection of that response.) The individual's correlation with the criterion group was then divided by the maximum point-biserial correlation of the same sign that the individual could have attained given the response proportions of the criterion group. (The maximum positive correlation would occur if the individual's responses matched perfectly the responses most often made by the criterion group for all items and the maximum negative correlation if his responses matched those least often made by the criterion group for all of the NVII items.) By dividing the two correlation coefficients, the range of possible scores for all scales was equated regardless of the homogeneity of the criterion group's responses.

The Clemans lambda coefficient which resulted was thus the ratio of the obtained to the maximum point-biserial correlation of the same sign and could assume values from 0.00 to 1.00. For lambda to be a useful index of the similarity between an individual's interests and those of a criterion group, however, some way of distinguishing between lambdas resulting from positive and those resulting from negative correlations was needed. Accordingly, the sign of the individual's correlation with the criterion group was affixed to lambda, making the range of possible values which lambda could assume -1.00 to 1.00. If an individual's interests were very similar to those of a criterion group, his score would be a high lambda with positive sign (e.g., .60, .71); if his interests were very different from those of a criterion group, his score would be a high lambda with negative sign (e.g., -.50, -.63).

Derivation of a Computing Formula for Lambda[6]

Applying the basic concepts of lambda scale construction,

$$\text{lambda} = \frac{\text{point-biserial } r}{\text{maximum point-biserial } r \text{ of same sign}} \quad . \qquad [1]$$

To simplify this equation for operational use, a familiar computing formula for the point-biserial correlation coefficient was used:

$$r_{p\ bis} = \frac{M_p - M_t}{\sigma_t} \sqrt{\frac{p}{q}} \quad , \qquad [2]$$

where M_p is the mean criterion group proportion for the N responses the individual endorses, and M_t is the mean criterion group proportion across all possible response positions for the items the individual answers. And:

$$r_{Max\ p\ bis} = \frac{M_{pp} - M_t}{\sigma_t} \sqrt{\frac{p}{q}} \quad , \qquad [3]$$

where M_{pp} is either the maximum possible mean criterion group proportion for the N responses the individual answers (which would be obtained by endorsing each of the N items with the most common response of the criterion group) or the minimum possible mean criterion group proportion (which would be obtained by endorsing each of the N items with the least common response of the criterion group). The maximum value is used when the numerator in Equation [1] is positive and the minimum value when the numerator is negative.

Substituting Equations [2] and [3] in Equation [1] and cancelling the common terms, the expression for lambda (λ) became:

$$\lambda = \frac{M_p - M_t}{M_{pp} - M_t} \quad . \qquad [4]$$

---

[6] In the body of this report, the NVII was described as a 190-item inventory where, for each item, the individual made one "like" and one "dislike" response--a total of 380 responses. For scoring purposes as described in this Appendix, however, each response is treated as a separate item, and the NVII is considered to have 380 "items."

This expression is the same as:

$$\lambda = \frac{\frac{\Sigma\text{Actual Proportions}}{N} - \frac{\Sigma\text{All Proportions}}{N'}}{\frac{\Sigma\text{Max or Min Proportions}}{N} - \frac{\Sigma\text{All Proportions}}{N'}} , \qquad [5]$$

where:

ΣActual Proportions = the sum of the criterion group's response proportions for those responses the individual endorses. (The individual selects one of the three possible response positions for each item he answers.)

ΣAll Proportions = the sum of the criterion group's response proportions across all possible response positions for the items the individual answers. (There are three possible response positions for each item answered.)

ΣMax Proportions = the sum of the criterion group's largest response proportions for those items the individual answers.

ΣMin Proportions = the sum of the criterion group's smallest response proportions for those items the individual answers.

N = the number of responses the individual makes.

N'= the number of possible response positions for all items the individual answers.

Since ΣProportions for each item = 1.00, ΣAll Proportions = N. Also, N' = 3N since there are three possible response positions for each item of the NVII. Substituting these values in Equation [5], the computing formula for λ became:

$$\lambda = \frac{3\Sigma\text{Actual Proportions} - N}{3\Sigma\text{Max or Min Proportions} - N} . \qquad [6]$$

The sign of the numerator of Equation [6] was then affixed to λ.

Sample Computation of Lambda

For ease of illustration, assume only a three-item interest inventory, each item of which has three possible response alternatives (a, b, and c). An individual selects responses a, b, and b, respectively, to items 1, 2, and 3. The response proportions of some criterion group (say storekeepers) for these items are as indicated below:

Item Number	Response	Response Proportions of Storekeeper Criterion Group	
		Responses Individual selected	Responses Individual did not select
1	a	.20	
	b		.50
	c		.30
2	a		.35
	b	.60	
	c		.05
3	a		.10
	b	.25	
	c		.65

Since the formula for λ is:

$$\lambda = \frac{3\Sigma\text{Actual Proportions} - N}{3\Sigma\text{Max or Min Proportions} - N},$$

the following terms are computed:

ΣActual Proportions = .20 + .60 + .25 = 1.05.

$\underline{N}$ = Number of items individual answered = 3.

ΣMaximum Proportions = .50 + .60 + .65 = 1.75.*

ΣMinimum Proportions = .20 + .05 + .10 = .35.*

Substituting these values, the numerator of the λ formula becomes:

$$3\Sigma\text{Actual Proportions} - \underline{N} = 3(1.05) - 3 = .15.$$

---

*Only one of these terms need be computed depending upon the sign of the numerator of λ. In this example, ΣMinimum Proportions was determined only for illustrative reasons.

This numerator has a positive value, so ΣMaximum Proportions (rather than ΣMinimum Proportions) is used in computing the denominator:

$$3\Sigma\text{Maximum Proportions} - \underline{N} = 3(1.75) - 3 = 2.25,$$

And

$$\lambda = \frac{.15}{2.25} = .07.$$

A positive sign is affixed to λ because the numerator of the λ equation (i.e., 3 ΣActual Proportions - $\underline{N}$) had a positive value. The individual's score on the three-item storekeeper scale is therefore +.07.

DISTRIBUTION LIST

Assistant Secretary of the Navy (Manpower and Reserve Affairs) (2)
Assistant Secretary of the Navy (Research and Development)
Chief of Naval Operations (OP-39); (OP-59); (OP-098T); (OP-099) (2); (OP-964); (OP-987F)
Chief of Naval Personnel (Pers-Od); (Pers-1); (Pers-5); (Pers-6); (Pers-11b); (Pers-2x); (Pers-212); (Pers-226); (Pers-52); (Pers-524); (Pers-61)
Chief of Naval Research (Code 458) (2)
Chief of Naval Technical Training
Chief of Naval Education and Training (Code N-33)
Chief of Naval Material (NMAT-03PB)
Office of Assistant Secretary of Defense (M&RA)
Commander in Chief, U. S. Pacific Fleet
Commander in Chief, U. S. Atlantic Fleet
Commander, Navy Recruiting Command (00); (015); (20); (312); (20a); (22); (24); (33)
Commander, Naval Training Center, Great Lakes
Commander, Naval Training Center, Orlando
Commander, Naval Training Center, San Diego
Commander and Director, Naval Electronics Laboratory Center (2)
Commanding Officer, Manpower and Material Analysis Center, Pacific
Commanding Officer, Naval Medical Neuropsychiatric Research Unit
Commanding Officer, Naval Aerospace Medical Institute (2)
Commanding Officer, Naval Examining Center (2)
Commanding Officer, Naval Submarine Medical Center (2)
Commanding Officer, Naval Medical Research Institute
Center for Naval Analyses
U. S. Army Enlisted Evaluation Center, Fort Benjamin Harrison (2)
Human Resources Development Div., U. S. Army Personnel & Administration Combat Developments Activity, Fort Benjamin Harrison
Army Research Institute for Behavioral and Social Sciences
Commander, Personnel Research Div., Air Force Human Resources Laboratory, Lackland Air Force Base (2)
Assistant Chief of Staff (G-1), U. S. Marine Corps
Headquarters, U. S. Marine Corps (Code A01B)
Commandant (Code B-5), U. S. Coast Guard
Superintendent, Naval Academy
Superintendent, Air Force Academy
Superintendent, Naval Postgraduate School
Superintendent (P), Coast Guard Academy
Superintendent, United States Military Academy
National Research Council, Washington, D. C.
National Science Foundation, Washington, D. C.
Director, Defense Documentation Center (Attn: DDC-TC) (12)