A FACTOR ANALYSIS OF THE BEHAVIORAL DIMENSIONS OF MARINE CORPS PERFORMANCE EVALUATION

Charles Allen Millard

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

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OF THE BEHAVIORAL DIMENSIONS OF
MARINE CORPS PERFORMANCE EVALUATION

by

Charles Allen Millard

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Thesis Advisor: Ronald A. Weitzman

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A Factor Analysis of the Behavioral Dimensions

of

Marine Corps Performance Evaluation

by

Charles Allen Millard
Captain, United States Marine Corps
B.A., Vanderbilt University, 1968

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I. INTRODUCTION

The purpose of this thesis is to conduct an analytic study of the Marine Corps' Performance Evaluation System to determine whether or not the system, as currently implemented, measures clearly, concisely, and unambiguously that which it is designed to measure. The study employs a statistical technique called factor analysis and relies on data supplied by Headquarters, United States Marine Corps (Code MMPA), Washington, D. C.

Performance evaluation in general, and the Marine Corps system in particular, are discussed. The factor analysis technique is developed, not rigorously, but in sufficient detail to allow readers to understand the meaning and significance of the results.

The data is then analyzed, showing the statistical correlations between the dimensions of the evaluation, leading to a demonstration of how the system could be streamlined by utilizing the few underlying factors rather than the many dimensions.

II. PERFORMANCE EVALUATION

A. GENERAL

The success or failure of any organization, large or small, complex or simple, military or civilian, is tied directly and inextricably to the performance of its personnel. This is not to say that other factors do not exist, or even that they are insignificant, but ultimately it is people--human beings--who make the organization succeed or fail. It is people who run the machines, program the computers, and make the important decisions. And it is people who determine the objectives of the organization, set its standards of performance and evaluate its personnel on the basis of those standards.

The key to this important determinant of organizational output is an effective and efficient personnel performance evaluation system. It is such a system which will, in the long run, determine the "quality" of the organizational actors and thus of the organization, for it determines who will rise to positions of leadership and authority, and who will be demoted--or even fired. "Quality" is used here in a relative sense, meaning "degree of excellence when compared to the organizational standards." More specifically, the system (ideally) measures the actual and potential contributions of the individual to the success of the organization.

All organizations use some type of performance evaluation system. People are always judging the performance of others--peers, subordinates, superiors. The system may be either formal or informal and its essential elements will vary widely, depending on the objectives, size, complexity and general structure of the organization itself. Each organization internally defines its own objectives, its own standards, and must, therefore, determine its own evaluation technique. By far the most common rating technique and the one used by the Marine Corps is the subjective rating scale in which several dimensions of an individual's performance are measured against a standard (below average, average, above average, etc.). The advantages of this technique are that it is clear and easy to use, but it is also subject to rater biases, leniency, central tendency, and the halo effect (having the rating on one dimension affect all others either positively or negatively).

Regardless of the technique used, however, the objectives of the performance evaluation system are generally the same. According to E. F. Huse (5), these objectives are:

1. Meeting organizational objectives and improving performance--the subordinate needs to know what his objectives are and to obtain feedback about his performance and areas for improvement;

2. Proper salary administration--the manager needs to review the performance of his subordinates in order to recommend proper salary action;

3. Collecting and storing data for future administrative actions on promotions, transfers, and demotions or discharges;

4. Identifying training needs--the organization needs to maintain accurate, current information about the strengths and weaknesses of its employees in order to develop timely and appropriate training programs;

5. Improving the selection of new employees--if an organization is to have a systematized, valid selection system, it needs proper criteria against which to validate its selection instruments.

A different technique or appraisal approach may be required for each of these objectives, but more often than not, organizations attempt to use an all-purpose form such as the subjective rating scale mentioned above to simultaneously satisfy all of them. This is not to imply a criticism of either the all-purpose approach or the organization opting to use it. The all-purpose form may satisfy the objectives of the organization to such an extent that the additional complexity of multiple-forms is not justified, or it may simply be an economic necessity.

B. PERFORMANCE EVALUATION IN THE MARINE CORPS

The objective of the Marine Corps performance evaluation system, as stated by Marine Corps Orders of the 1610.7-series is to provide, for all officers and noncommissioned officers, a fitness report which is an evaluation of duties performed and the manner in which performed. Such reports represent a com-

prehensive portrayal of the professional qualifications, personal traits and characteristics, and potential of the individual. The order further states that fitness reports are the principal record of a Marine's performance and conduct and as such are vital in determining duty assignments and in selection for promotion. The system, as thus described by the order, embraces three of Huse's five objectives, omitting the objectives of providing records for training and selection of new employees. The requirements for such records obviously exists within the Marine Corps, but they are satisfied by other means. The principal instrument of the Marine Corps system is a single, all-purpose subjective rating form, an example of which is contained in Appendix A. The form provides for the measurement of 21 dimensions of performance on a rating scale from unsatisfactory to outstanding. There is also a provision for a rating of "Not Observed" in case a particular performance dimension is not demonstrated during the period of the report.

The Marine Corps Order defines 14 of the 21 performance dimensions. They are:

1. Endurance: Physical and mental ability to carry on under fatiguing conditions.

2. Personal Appearance: The trait of habitually appearing neat, smart, and well-groomed in uniform or in civilian attire.

3. Military Presence: The quality of maintaining appropriate dignity and soldierly bearing.

4. Attention to Duty: Industry, the trait of working thoroughly and conscientiously.

5. Cooperation: The faculty of working in harmony with others, both military and civilian.

6. Initiative: The trait of taking necessary or appropriate action on own responsibility.

7. Judgment: The ability to think clearly and arrive at logical conclusions.

8. Presence of Mind: The ability to think and act promptly and effectively in an unexpected emergency or under great strain.

9. Force: The faculty of carrying out with energy and resolution that which is believed to be reasonable, right or duty.

10. Leadership: The capacity to direct, control, and influence others and still maintain high morale.

11. Loyalty: The quality of rendering faithful and willing service, and unswerving allegiance under any and all circumstances.

12. Personal Relations: Faculty for establishing and maintaining cordial relations with both military and civilian associates.

13. Economy in Management: Effective utilization of men, money, and materials.

14. Growth potential: The capacity for professional development.

The remaining 7 of the 21 dimensions are undefined and left

to the interpretation of the rater. Implicit in this omission is the assumption that they are self-explanatory, an assumption which may or may not be justified. These undefined dimensions are:

1. Regular duties
2. Additional duties
3. Administrative duties
4. Handling officers
5. Handling Enlisted Personnel
6. Training Personnel
7. Tactical Handling of Troops

The report provides for the appraisal of a final dimension, entitled "General Value to the Service". This item is the last evaluation on the fitness report and there is a temptation, consciously or otherwise, for the raters to treat it as a composite or average of the previous 21 marks. The Marine Corps Order, however, clearly and specifically advises against this, stating that it should be an estimate of how the Marine compares with all other Marines of the same grade (rank) known to the rater, taking into consideration all important factors. It is thus intended to be a separate and unique mark, not a composite.

All dimensions except the last (General Value to the Service) are rated on a six-point scale from unsatisfactory to outstanding. The scale values, with definitions from the order, are as follows:

1. Outstanding: one of the clearly superior individuals of his grade known to the reporting officer (rater).

2. Excellent: qualified to a degree seldom achieved by others of his grade.

3. Above Average: highly qualified.

4. Average: qualified to a generally accepted standard.

5. Below Average: below the generally accepted standard.

6. Unsatisfactory: unacceptable performance.

The final dimension is rated on a ten-point scale, using the six scale values defined above plus intermediate values among the top five, i.e., between below average and average, between average and above average, etc..

A careful examination of the definitions of the dimensions of the Marine Corps fitness report reveals a potential for overlap or confusion among them. For example, the definition of initiative implies a certain amount of judgment, since it specifies "appropriate action". Similarly, it is difficult to imagine good personal relations in the absence of a positive spirit of cooperation. To the developers of the form, each dimension undoubtedly applies to a separate and distinct aspect of performance, but what about to the users? Are they able to make the subtle distinctions or are they, in fact, evaluating a smaller number of dimensions by basing their evaluations of several dimensions on a single characteristic as they see or are mentally able to define it. If overlap actually does exist, the question arises as to whether or not the number of dimensions could be reduced to the point where users are able to

clearly distinguish among them. Simplicity is certainly a worthy objective of any rating system, and if the form could be simplified to a smaller number of dimensions which the users see as distinct and unambiguous, while still providing an adequate evaluation of the relevant dimensions of performance, then such a step would necessarily be an improvement.

To test the hypothesis that simplification is possible, that the essential characteristics of individual performance could, in fact, be evaluated by using a smaller number of dimensions, a large body of summary fitness report data was subjected to an analytic technique called factor analysis.

III. FACTOR ANALYSIS

This chapter presents background information concerning factor analysis and discusses the methodology used in this study. Factor analysis is a statistical technique formulated by psychologists at the turn of this century to provide mathematical models for the development of psychological theories of human ability and behavior. Because of its origin and extensive use in psychology, it is often regarded as psychological theory, but it has been adapted for use in other areas where numerous interacting measurements are obtained. Its use has greatly expanded as a consequence of the development of high-speed electronic computers.

Since the objective of this study is to subject a set of Marine Corps fitness report data to factor analysis, rather than to either develop or illustrate factor analysis itself, the technique will not be described in great detail. What will be presented is just enough for the reader to be able to follow and understand the origin and nature of the answers and conclusions which result. For a more thorough discussion of the technique, the reader is directed to any of the references listed in the bibliography, especially the one by H. H. Harmon.

It should also be noted at this point that a Biomedical (BIMED) computer program (BMD08M) was used in this analysis, so the computational details are not required to either

achieve or understand the results. A general understanding of the technique is, however, essential.

A. OBJECTIVES OF FACTOR ANALYSIS

The primary objective of factor analysis is to obtain a parsimonious description of observed data. Harmon (4) sees it as a technique to resolve a set of variables into a small number of elements, called factors. Resolution is accomplished by the analysis of the correlations between the variables. Factor analysis, then, is essentially a linear regression of each of the variables on the factors. It yields factors which provide an adequate fit to the data, while maintaining all the essential information of the original set of variables.

B. THE FACTOR ANALYSIS MODEL

It is the object of factor analysis to represent a variable V_i in terms of several underlying factors, or hypothetical constructs. Several types of factors may be distinguished:

1. Common Factors

    a. General factor: present in all variables.

    b. Group factor: present in more than one, but not all, variables.

2. Unique Factors: present in only a single variable.

Common factors account for the intercorrelations among the

variables, while each unique factor represents that portion of a variable not attributable to its correlations with other variables of the set.

The simplest mathematical model for describing one variable in terms of several others is a linear one, and that is the form of representation used in factor analysis models. Using the notation $F_1, F_2, F_3, \cdots, F_m$ for m common factors, the complete linear expression for any variable V_i may be written in the form

$$(3\text{-}1) \qquad V_i = a_{i1}F_1 + a_{i2}F_2 + a_{i3}F_3 + \cdots + a_{im}F_m$$

where $i = 1, 2, \cdots, n$ and a_{ij} is the coefficient of the j^{th} factor of the i^{th} variable. There are, of course, n equations of this form--one for each of the n variables. Some models also include a term a_iU_i which denotes the unique aspect of any variable--i.e., that portion of its variance which is not attributable to any common factor. Since factor analysis in general, and this paper in particular, is concerned primarily with the common factors, the unique term will not be included in the model used herein.

C. FACTOR LOADING AND COMMUNALITY

The coefficients a_{ij} in equation (3-1), also called factor loadings, can be determined through an analysis of the correlations among the n variables. All m factors are

required to reproduce the correlation among the original n variables, and each factor, through its loading, is selected to make maximum contribution to the sum of the variances of the original variables. The first such factor selected makes the greatest single contribution; the second makes a maximum contribution to the remaining variance, and so on until a satisfactory portion (usually less than 100%) of the total original variance has been accounted for. Thus, depending on the amount of variance which will give a satisfactory and acceptable solution, only a small number (less than n) of factors will be needed to reproduce the original data.

For any particular variable, the amount of its total variance accounted for by the common factors is called its communality. Quantitatively, the communality of a variable is given by the sum of the squares of the common-factor coefficients, viz.

$$(3\text{-}2) \qquad h_i^2 = a_{i1}^2 + a_{i2}^2 + a_{i3}^2 + \cdots + a_{in}^2$$

where h_i^2 is the communality of the i^{th} variable V_i and the a_{ij} are its factor coefficients.

The residual variance (one minus the communality) is the extent to which the variable is unique. It should be noted that although the communality can be increased by simply increasing the number of common factors extracted from the set of variables, this is not, in general, desirable.

Parsimonious description of the data requires that the number of factors be kept to a minimum.

Factor analysis techniques require communality estimates as inputs. Successive iteration then leads to the final correct communality values. Making the original estimate, however, can sometimes pose a difficult problem. There are three principal and commonly used estimating techniques. They are:

1. Set the original communality estimate equal to one for all variables--i.e., assume that all of the variance of the variables will be accounted for by the factors selected.

2. Use the squared multiple correlations as the communality estimates.

3. Use the maximum row values of the correlation matrix as the communality estimate.

These three techniques are discussed in detail by Harmon (4) and others and each has considerable merit in a variety of circumstances. The first technique listed above was used for this study, not because of any intrinsic superiority, but simply because of the author's subjective judgment.

Having determined the communalities, it is then possible to calculate the factor coefficients, or loadings. The most frequently used technique (principal-component) begins by choosing a set of factors in decreasing order of their contribution to the total communality. The analysis is begun by extracting a factor F_1 whose contribution to the communalities of the variables is as great as possible. Then the

first-factor residual correlations are obtained. A second factor F_2 with a maximum contribution to the residual communality is next found. This process is continued until the total communality has been analyzed.

The first-factor coefficients a_{j1} are selected to maximize the sum of the contributions of that factor to the total communality. For the first factor (F_1), this sum is given by

$$C_1 = a_{11}^2 + a_{21}^2 + a_{31}^2 + \cdots + a_{n1}^2. \tag{3-3}$$

The coefficients a_{i1} in equation (3-3) must be chosen so as to maximize C_1 under the constraint (for m factors)

$$r_{ik} = \sum_{p=1}^{m} a_{ip}a_{kp} \qquad (i,k = 1, 2, 3, \cdots, n) \tag{3-4}$$

where $r_{ik} = r_{ki}$ and r_{ii} is the communality of variable V_i (i.e., $r_{ii} = h_i^2$). The constraint condition (3-4) says that the reproduced correlations are to be replaced by the observed correlations, implying the assumption of no unique variance (i.e., zero residual error). Recall that it was earlier stated that the unique factor would not be included in this model.

Maximization of this function (3-3) of n variables, constrained by $\frac{1}{2}n(n+1)$ conditions (3-4), is greatly facilitated by the method of Lagrange multipliers, which may be

applied as follows: define the Lagrangian function (L) such that

$$(3\text{-}5) \qquad 2L = C_1 - \sum_{i,k=1}^{n} \mu_{ik} r_{ik} = C_1 - \sum_{i,k=1}^{n} \sum_{p=1}^{m} \mu_{ik} a_{ip} a_{kp}$$

where the μ_{ik} ($= \mu_{ki}$) are the Lagrange multipliers. Then set the partial derivative of L with respect to any one of the n variables (a_{i1} with $i = 1, 2, \cdots, n$) equal to zero:

$$(3\text{-}6) \qquad \frac{\partial L}{\partial a_{i1}} = a_{i1} - \sum_{k=1}^{n} \mu_{ik} a_{k1} = 0.$$

Similarly, set the partial derivative of L with respect to any of the other coefficients (a_{ip} for $p \neq 1$) equal to zero:

$$(3\text{-}7) \qquad \frac{\partial L}{\partial a_{ip}} = - \sum_{k=1}^{n} \mu_{ik} a_{kp} = 0.$$

The two sets of equations, (3-6) and (3-7), may be combined as follows:

$$(3\text{-}8) \qquad \frac{\partial L}{\partial a_{ip}} = (\delta_{1p} a_{i1}) - \sum_{k=1}^{n} \mu_{ik} a_{kp} = 0$$

where $p = 1, 2, \cdots, m$ and the Kronecker Delta, $\delta_{1p} = 1$ if $p = 1$ and $\delta_{1p} = 0$ if $p \neq 1$. Multiplying equation (3-8) by a_{i1} and summing with respect to i leads to:

$$\delta_{1p} \sum_{i=1}^{n} a_{i1}^2 - \sum_{i=1}^{n} \sum_{k=1}^{n} \mu_{ik} a_{i1} a_{kp} = 0. \tag{3-9}$$

Since, according to equation (3-6),

$$a_{k1} = \sum_{i=1}^{n} \mu_{ik} a_{i1}$$

then, by letting

$$\lambda_i = \sum_{i=1}^{n} a_{i1}^2$$

where λ is used for convenience only at this point but will be defined more rigorously later, equation (3-9) becomes

$$\delta_{1p} \lambda_1 - \sum_{k=1}^{n} a_{k1} a_{kp} = 0. \tag{3-10}$$

Multiplying by a_{ip} and summing with respect to p, equation

(3-10) becomes

$$a_{i1}\lambda_1 - \sum_{k=1}^{n} a_{k1}\left[\sum_{p=1}^{n} a_{ip}a_{kp}\right] = 0. \qquad (3\text{-}11)$$

Applying the constraining conditions (3-4) to equation (3-11), the result is

$$\sum_{k=1}^{n} r_{ik}a_{k1} - \lambda_1 a_{i1} = 0 \qquad (i = 1, 2, \cdots, n) \qquad (3\text{-}12)$$

which is a system of n equations. Recalling that $r_{ii} = h_i^2$ and dropping the subscript of λ_1 for convenience, this system of n equations may be written as follows:

$$(3\text{-}13)\quad \begin{cases} (h_1^2 - \lambda)a_{11} + r_{12}a_{21} + \cdots + r_{1n}a_{n1} = 0 \\ r_{21}a_{11} + (h_2^2 - \lambda)a_{21} + \cdots + r_{2n}a_{n1} = 0 \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdots \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ r_{n1}a_{11} + r_{n2}a_{21} + \cdots + (h_n^2 - \lambda)a_{n1} = 0 \end{cases}$$

The existence of a nontrivial solution to this system of equations requires that the determinant of the coefficients vanish, as follows:

$$(3\text{-}14)\quad \begin{Bmatrix} h_1^2 - \lambda & r_{12} & \cdots & r_{1n} \\ r_{21} & h_2^2 - \lambda & \cdots & r_{2n} \\ \cdot & \cdot & \cdots & \cdot \\ r_{n1} & r_{n2} & \cdots & h_n^2 - \lambda \end{Bmatrix} = 0$$

Expansion of this determinant results in an n^{th} order polynomial in λ, known as the characteristic equation (of the system). The polynomial has a family of solutions, all of which are proportional to one particular solution, with the factor of proportionality given by

$$\lambda_1 = \sum_{i=1}^{n} a_{i1}^2 .$$

Recall, however, from equation (3-3), that this is precisely the quantity to be maximized. It follows, therefore, that the maximizing solution to C_1 is the largest root of the characteristic equation. To find the coefficients of the first factor (F_1) which will account for the maximum amount of communality, the value of λ_1 is now substituted into the set of equations (3-13) and any solution $\alpha_{11}, \alpha_{21}, \cdots, \alpha_{n1}$ is obtained. To satisfy the conditions of equation (3-3), these values are divided by the square root of the sum of their squares and multiplied by $\sqrt{\lambda_1}$. The resulting quantities are the desired coefficients of F_1 in the factor pattern (3-1):

$$\text{(3-15)} \qquad a_{i1} = \frac{\alpha_{i1}\sqrt{\lambda}}{\sqrt{\alpha_{11}^2 + \alpha_{21}^2 + \cdots + \alpha_{n1}^2}}$$

where $i = 1, 2, \cdots, n$. In the literature of mathematics, the roots (λ's) of the characteristic equation are called eigenvalues, while the solution to the set of equations (3-14)

corresponding to each eigenvalue leads to a vector (a set of α's) which is called an eigenvector.

The problem now remains to find the coefficients of the remaining factors, accounting for a maximum amount of the residual communality. The residual correlation after the first factor has been extracted is given by

$$(3\text{-}16) \qquad r'_{ik} = r_{ik} - a_{i1}a_{k1} \quad .$$

and the quantity to be maximized is

$$(3\text{-}17) \qquad C_2 = a^2_{12} + a^2_{22} + \cdots a^2_{n2}$$

subject to the constraint condition of (3-16). Iteration of the method of Lagrange multipliers yields λ_2, the second largest eigenvalue, as the maximizing value of C_2. The second-factor coefficients are then determined as above. Successive iteration of this procedure will eventually produce the complete set of factor coefficients, or loadings.

D. FACTOR ROTATION

Once a set of factor loadings has been calculated, the next step in the analysis is to interpret the factors in a way that will give a meaningful summary of the observed data. Since the factor loadings are produced in an arbitrary frame of reference, the problem is to choose a reference frame for

the factor loading points which will give the most meaningful and/or most useful interpretation. To this end, the arbitrary frame of reference may be rotated to one more suited to interpretation. There are numerous rotational techniques and criteria to select from. Thurstone (10), for example, has specified his criteria for simple structure which ideally would result in a relatively unique configuration of factor loadings and a relatively standard location for the reference frame. As pointed out by Morrison (8), however, the problem with these criteria is that they rarely exist when using real data. For simplicity, rotational techniques can be grouped into two broad classes: orthogonal and oblique. Although orthogonal rotation is not suitable for all data, it has at least one distinct advantage. Since the resulting factors are orthogonal, they are uncorrelated (independent), which greatly facilitates interpretation. It should also be pointed out that the varimax orthogonal rotation technique was developed by Kaiser (6) in 1958 to allow actual data to meet Thurstone's simple structure criteria as closely as possible. This is the rotational technique which was used in this study.

E. FACTOR SCORES

From a purely theoretical point of view, the common factors have a more fundamental importance than the observed variables themselves and it is therefore necessary to relate the observations to the common factors. This is done by means of factor scores, which are a means of expressing

quantitatively the information contained in a factor for a specific case or individual. Through the factor scores, the difference between two cases can be expressed in terms of the reproduced correlations of the original data.

The computation of factor scores is based on the factor loadings previously determined. When using ones on the main diagonal of the correlation matrix, as in this study, the principal-factor solution may be expressed in matrix notation as follows:

(3-18) $$V = AF$$

where

V = n X 1 column vector of variables,

A = n X n matrix of factor loadings, and

F = n X 1 column vector of factor scores.

The factor scores are then given by:

(3-19) $$F = A^{-1}V.$$

F. FACTOR INTERPRETATION

After the factor loadings and factor scores have been determined, there remains only the task of interpretation. A complete solution requires an identification of the nature and content of the hypothetical factors. Fruchter (3) indicates that this is commonly done by inferring what the variables with high loadings on a factor have in common that is present to a lesser degree in variables with moderate or low

loadings and absent from variables with zero (or near zero) loadings. He further defines an arbitrary classification scheme for factor loadings, as follows:

1. Insignificant: factor loading below 0.2
2. Low: factor loading of 0.2 to 0.3
3. Moderate: factor loading of 0.3 to 0.5
4. High: factor loading of 0.5 to 0.7
5. Very high: factor loading above 0.7.

Although Fruchter's classification scheme is admittedly arbitrary, this phase of the analysis is necessarily less objective and more subject to the desires and experience of the analyst than that which preceded. Even so, there is quantitative justification for at least a portion of his classification scheme. Recall that in linear regression, the square of the correlation coefficient indicates the proportion of the total variance explained by the regression. Thus, a factor loading of 0.7, which separates the "high" and "very high" classifications, corresponds to a level of correlation between the variable and factor in which nearly one half of the observed variance has been accounted for.

A factor loading of 0.7 will therefore be adopted in this study as being indicative of a "significant" correlation between variable and factor. From there, an attempt will be made to assign convenient, understandable, and unambiguous names to the factors, based on an observation of those variables with significant loadings.

IV. THE DATA

The data for this study consisted of the fitness report summaries from 450 randomly selected Master Brief Sheets (form NAVMC HQ 466) for Marine Corps Officers in the grades Second Lieutenant through Colonel. The data was furnished by Headquarters, U. S. Marine Corps (Code MMPA) upon my official written request. Each Master Brief Sheet represents a complete fitness report record for a particular individual since mid-1972, when the Performance Evaluation System was automated. It contains all of the evaluations for the 22 dimensions previously discussed. The personal information from Section A of the fitness report (see Appendix A) had been deleted from each Brief Sheet to insure the confidentiality of each individual's record.

Of the original 450 Master Brief Sheets, 46 were found to contain insufficient information to be useful in this study. Additionally, four of the 22 dimensions were dominated by "Not Observed" marks and were therefore eliminated from analysis. The eliminated dimensions, with percentage of "Not Observed" marks, were as follows:

1. Additional Duties - 89%
2. Tactical Handling - 87%
3. Endurance - 62%
4. Presence of Mind - 93%

Since each Brief Sheet represents a separate observation of the variables (dimensions of performance), the data for the analysis consisted of 404 observations of 18 variables.

Since the factor analysis technique is essentially mathematical in nature, it was necessary to convert the subjective non-numeric scale (excellent, above average, etc.) used by the reporting officers to a numeric scale suitable for the analytic technique. To do this it was first necessary to make an assumption about the distribution of the attributes which the fitness report is designed to measure. The Normal, or Gaussian, Distribution was assumed for this study, as is common in such cases. The argument for use of the Normal Distribution is strengthened by the fact that arithmetic means of variable markings were eventually used in the analysis. By the Central Limit Theorem, these means tend to be normally distributed, regardless of the actual underlying distribution (9).

In a random sample of 100 fitness reports (from the 404 Master Brief Sheets), the frequency, relative frequency, cumulative relative frequency, and standard normal deviate (z-value) for each mark, or scale value (excellent, etc.) were determined. The results are shown in Table I.

To calculate the mean, or expected value, of each of these marks (denoted by $\bar{X}$), let $f(X)$ represent the distribution function of the marks within the interval $[z_1, z_2]$, where z_1 and z_2 are the minimum and maximum standard normal deviates, respectively, of the mark. The expected

Table I. Distribution of Marks

MARK	FREQ	REL. FREQ	CUM REL FREQ	Z-VALUE
Unsatisfactory	1	0.0006	0.0006	-3.2200
Below Average	2	0.0012	0.0018	-2.9100
Average	7	0.0041	0.0059	-2.5200
Above Average	102	0.0600	0.0659	-1.5069
Excellent	781	0.4594	0.5253	0.0635
Outstanding	807	0.4747	1.0000	....

value is then given by:

$$\text{(4-1)} \qquad \bar{X} = \frac{\int_{z_1}^{z_2} X\, f(X)\, dx}{\int_{z_1}^{z_2} f(X)\, dx} .$$

Since the normal distribution has been assumed, f(X) is given by:

$$\text{(4-2)} \qquad f(X) = \frac{1}{\sqrt{2\pi}} e^{-x^2/2} \qquad (-\infty < x < \infty).$$

After substitution and integration, the desired scale values are given by:

$$\text{(4-3)} \qquad \bar{X} = \frac{-\frac{1}{\sqrt{2\pi}} \left[e^{-0.5z_2^2} - e^{-0.5z_1^2} \right]}{F(z_2) - F(z_1)}$$

where the numerator can be determined by direct substitution of the z-values and the denominator can be determined from any table of areas under the normal curve.

As an illustrative example, let $\bar{X}_{un}$ denote the value of an unsatisfactory mark. Then

$$\bar{X}_{un} = \frac{-\frac{1}{\sqrt{2\pi}} \left[e^{-0.5(-3.22)^2} - e^{-0.5(-\infty)^2} \right]}{F(-3.22) - F(-\infty)}$$

which, after substitution and reduction becomes

$$\bar{X}_{un} = \frac{-(0.3989)\ (0.0056 - 0)}{(0.0006 - 0)}$$

$$= -3.7264.$$

Similarly, $\bar{X}_{ba}$, the value of a Below Average mark is given by:

$$\bar{X}_{ba} = \frac{-\frac{1}{\sqrt{2\pi}}\left[e^{-0.5(2.91)^2} - e^{-0.5(-3.22)^2}\right]}{F(-2.91) - F(-3.22)}$$

$$= \frac{-(0.3989)\ (0.0145 - 0.0056)}{(0.0018 - 0.0006)}$$

$$= -2.9552.$$

The results of these calculations were then subjected to a linear transformation to eliminate negative signs and decimal points. The transformation was of the form

(4-4) $$T = 1000\ (X + 4)$$

where X is the scale value obtained from equation (4-3) and T is the more convenient transformed value. The results of these calculations and transformations are shown in Table II.

The transformed values (T) were then substituted for their corresponding markings on each of the fitness reports and a statistical average for each of the 18 variables was obtained for each of the 404 individuals comprising the data base. The average values for each of the individuals, rather

Table II. The Numeric Marking Scale

MARKS	ORIGINAL VALUE (X)	TRANSFORMED VALUE (T)
Unsatisfactory	- 3.7264	0273
Below Average	- 2.9552	1045
Average	- 2.6556	1344
Above Average	- 1.8585	2142
Excellent	- 0.5876	3412
Outstanding	0.8387	4839

than the value of each mark on each of the available fitness reports, was used in the factor analysis to minimize the effect of "random error" caused by improper marking and rater bias. The result is the 404 by 18 matrix of markings contained in Appendix B.

In addition to quantifying the individual markings, it was necessary to assign numbers to the variables to be analyzed, a somewhat more simple task. The numbering scheme is shown in Table III.

Table III. Variables to be Analyzed

VARIABLE NUMBER	BEHAVIORAL DIMENSION
1	Regular Duties
2	Administrative Duties
3	Handling Officers
4	Handling Enlisted
5	Training Personnel
6	Personal Appearance
7	Military Presence
8	Attention to Duty
9	Cooperation
10	Initiative
11	Judgment
12	Force
13	Leadership
14	Loyalty
15	Personal Relations
16	Economy in Management
17	Growth Potential
18	General Value to the Service

V. THE ANALYSIS

Analysis of the data from the 404 observations of the 18 variables was accomplished in two major steps. The first step utilized the complete data set, treating the sample population as an integral whole. In the second step, the data was separated into subsets, one subset for each rank (Second Lieutenant through Colonel) and one subset each for Company Grade Officers (Second Lieutenant, First Lieutenant, and Captain) and Field Grade Officers (Major, Lieutenant Colonel, and Colonel). The second step constituted an effort to determine whether or not significant observable differences in factor structure exist between the various subgroups. In both steps, the data was analyzed using the Biomedical Factor Analysis program BMD08M. The type of rotation and the number of factors extracted were varied in an attempt to account for the variance of a maximum number of variables. After a number of trial runs of the program, it was determined that varimax orthogonal rotation for three factors produced very high factor loadings (greater than 0.7) on 12 of the 18 variables and accounted for 73.5% of their total variance. The next best combination of number of factors and rotation technique produced very high factor loadings on only 10 variables, without an increase in the proportion of total variance accounted for. The three-factor varimax orthogonal

rotation procedure was therefore selected for use in the remainder of the analysis.

A. ANALYSIS OF THE COMPLETE DATA SET

Since factor analysis is essentially an analysis of the correlations between variables, a logical starting point is an examination of the correlation matrix, reproduced in Table IV. This table shows the correlations between all possible pairs of variables. It shows a wide range of correlations, from 0.31 to 0.84, and indicates that there is, in fact, a high correlation between some of the variables. It does little, however, to illuminate a pattern which might reveal the underlying factors. The most essential and useful information is contained in the matrix of factor loadings, shown in Table V.

Using the criterion, previously established, of very high factor loadings being significant, Table V shows that the following variables have significant loadings on the first factor:

1. Regular Duties (variable 1)
2. Training Personnel (variable 5)
3. Initiative (variable 10)
4. Judgment (variable 11)
5. Force (variable 12)
6. Leadership (variable 13)
7. Economy in Management (variable 16)

This means that these seven variables are all closely related

Table IV. Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.0	.71	.64	.61	.62	.43	.64	.73	.59	.76	.76	.66	.78	.50	.57	.67	.66	.84
2	.71	1.0	.53	.49	.53	.37	.55	.70	.56	.69	.70	.59	.65	.49	.52	.65	.56	.69
3	.64	.53	1.0	.69	.57	.43	.61	.61	.57	.55	.69	.60	.73	.39	.58	.54	.56	.67
4	.61	.49	.69	1.0	.60	.37	.58	.58	.58	.60	.64	.62	.72	.45	.56	.54	.59	.67
5	.62	.53	.57	.60	1.0	.36	.50	.56	.46	.62	.61	.61	.66	.37	.48	.56	.53	.66
6	.43	.37	.43	.37	.36	1.0	.73	.37	.35	.36	.40	.35	.51	.31	.40	.32	.60	.57
7	.64	.55	.61	.58	.50	.73	1.0	.63	.56	.61	.64	.60	.74	.44	.56	.54	.71	.76
8	.73	.70	.61	.58	.56	.37	.63	1.0	.66	.76	.72	.64	.73	.58	.59	.66	.64	.78
9	.59	.56	.57	.58	.46	.35	.56	.66	1.0	.56	.62	.46	.62	.58	.74	.56	.55	.64
10	.76	.69	.55	.60	.62	.36	.61	.76	.56	1.0	.75	.71	.74	.51	.50	.67	.66	.79
11	.76	.70	.69	.64	.61	.40	.64	.72	.62	.75	1.0	.66	.77	.50	.63	.70	.65	.80
12	.66	.59	.60	.62	.61	.35	.60	.64	.46	.71	.66	1.0	.73	.44	.43	.62	.59	.69
13	.78	.65	.73	.72	.66	.51	.74	.73	.62	.74	.77	.73	1.0	.48	.61	.65	.73	.82
14	.50	.49	.39	.45	.37	.31	.44	.58	.58	.51	.50	.44	.48	1.0	.50	.42	.41	.56
15	.57	.52	.58	.56	.48	.40	.56	.59	.74	.50	.63	.43	.61	.50	1.0	.55	.53	.63
16	.67	.65	.54	.54	.56	.32	.54	.66	.56	.67	.70	.62	.65	.42	.55	1.0	.56	.65
17	.66	.56	.56	.59	.53	.60	.71	.64	.55	.66	.65	.59	.73	.41	.53	.56	1.0	.78
18	.84	.69	.67	.67	.66	.57	.76	.78	.64	.79	.80	.69	.82	.56	.63	.65	.78	1.0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Table V. Factor Loading Matrix

	FACTOR		
VARIABLE	1	2	3
1	0.7435	0.2861	0.3664
2	0.6749	0.1574	0.4105
3	0.5836	0.3968	0.3330
4	0.5975	0.3330	0.3543
5	0.7267	0.2429	0.1574
6	0.1319	0.9116	0.1487
7	0.4413	0.7385	0.3037
8	0.6662	0.2062	0.5195
9	0.3395	0.2267	0.8000
10	0.7970	0.2003	0.3170
11	0.7270	0.2691	0.4168
12	0.8046	0.2404	0.1459
13	0.7196	0.4504	0.3269
14	0.2664	0.1244	0.7469
15	0.2992	0.3126	0.7425
16	0.7209	0.1189	0.3571
17	0.5344	0.6094	0.2694
18	0.6878	0.4754	0.4018

to a single underlying factor and could be more efficiently represented by a single dimension--i.e., by a single question on the fitness report. Assigning an acceptable name to the factor requires both insight and judgment. An examination of the component variables reveals that they are principally task or goal oriented. They all measure some aspect of how an individual performs on the job. Since the sample population consists entirely of officers, it can be assumed that a typical job for a member of the sample is more than routinely mechanical. It undoubtedly requires leadership capability, coupled with force, initiative, and judgment. Economy in Management can be regarded as a measure of effectiveness of job performance and since nearly all Marine Officers have subordinates in their charge, the military concept of leadership implies a training function in nearly all jobs. Thus, all the variables with very high loadings on the first factor can be regarded as elements of task orientation or accomplishment.

Additional insight into the nature of the first factor can be gained from an examination of those variables which, although not having "very high" factor loadings, nevertheless had higher loadings on this factor than on either of the other two. They are:

1. Administrative Duties (variable 2)
2. Handling Officers (variable 3)
3. Handling Enlisted (variable 4)
4. Attention to Duty (variable 8)
5. General Value to the Service (variable 18)

Given the assumption that every Marine Officer interacts with both officer and enlisted subordinates in the performance of his duties, these variables are also task or goal oriented, with the possible exception of variable 18. Deferring discussion of variable 18 for the moment, it seems safe to assign to the first factor a name such as "Task Orientation and Effectiveness".

Turning now to the second factor, the variables with very high factor loadings are:

1. Personal Appearance (variable 6)
2. Military Presence (variable 7).

These variables relate to how an individual appears and how he behaves, both of which are external manifestations of an internal quality which may be called pride or self-image. It is interesting to note that the highest factor loadings of all the cases occurred here, for Personal Appearance on factor two. Apparently, then, the external manifestation is as important as the underlying self-image. In order to include both aspects, and to eliminate any confusion with currently used names, the second factor will be called "Self-image and Bearing".

The third and final factor had three variables with very high loadings. They are:

1. Cooperation (variable 9)
2. Loyalty (variable 14)
3. Personal Relations (variable 15)

Just as the first factor was clearly task-oriented, the

third is clearly people-oriented. It measures interpersonal behavior, or interaction. In one sense it also measures team spirit, since loyalty is presumably on a professional rather than personal level and applies to either the organization or its goals. The cooperation and personal relations, then, are with other members of the team. These variables measure more than just "spirit", however. They also include a measure of how effectively the team spirit is established and maintained. The third factor was therefore called "Team Orientation and Effectiveness".

The three factors measured by a Marine Corps fitness report, then, relate principally to the task, the self, and the team. The three factors, using the names assigned above, are:

1. Task Orientation and Effectiveness
2. Self-image and Bearing
3. Team Orientation and Effectiveness

Two of these three factors correspond very closely to the results of a factor analysis conducted by Fleishman, Harris, and Burtt at Ohio State University (2). Their research was an attempt to isolate and define certain basic factors relating to leadership and supervision in industry. They developed and administered a leadership description questionnaire which was then factor-analyzed. Their factor analysis produced two common factors, which they called "Initiating Structure" and "Interpersonal Effectiveness". The performance variables which factored into components of "Initiating Structure"

included those relating to patterns of task accomplishment. Explicit in this factor were the behavioral dimensions of leadership and aggressiveness (force). Their study did not identify a factor comparable to "Self-image and Bearing", however. Such factors would seem to be limited to organizations for which external image or appearance is important--as in the military services or certain large corporations, but not in industry (the environment for the Ohio State study).

As stated earlier, the three common factors of this study collectively accounted for 73.5% of the total variance of all the variables. The equivalent information for any specific variable is contained in its communality, which is the proportion of its variance accounted for by the common factors. The communality of each of the variables is shown in Table VI.

At this point it is possible to speculate about the significance of variablé 18, General Value to the Service. If this variable actually measures what its terms and definition indicate it should measure, it could indicate the relative importance of the three factors to the Marine Corps. For example, its highest loading is on the first factor. This could, and probably does, indicate that Task Orientation and Effectiveness is the most important single dimension of Marine Corps performance, followed, though not too closely, by the second and third factors in that order. This is not a particularly surprising result, since the military community commonly stresses the primary importance of the mission (task).

Table VI. Communalities

VARIABLE	COMMUNALITY
1	0.7689
2	0.6489
3	0.6089
4	0.5934
5	0.6119
6	0.8706
7	0.8324
8	0.7562
9	0.8067
10	0.7757
11	0.7747
12	0.7264
13	0.8274
14	0.6442
15	0.7385
16	0.6614
17	0.7295
18	0.8605

As a final step in the analysis it was necessary to compare the relative scores of the 404 individuals on the three factors. This is the information that would be contained in a fitness report if the three factors, rather than the 18 variables, were used. The table of factor scores in Appendix C, then, represents the fitness report data for the 404 individuals in reduced form. A comparison of Appendices B and C reveals that those individuals with low scores on the first factor received low markings on one or more of the variables of which that factor is composed. Similarly, high factor scores equate to high markings.

As an illustrative example, individual (case) number 367 has a factor score of -5.05024 on the second factor. Appendix B reveals that this individual had markings of 1382 and 1776 on the Personal Appearance and Military Presence variables, respectively. On the actual fitness reports for this individual, these numbers correspond to the following markings (for six reports):

1. Personal Appearance: two Above Average, two Average, one Below Average and one Unsatisfactory.

2. Military Presence: four Above Average and two Below Average.

This is admittedly an extreme example, but it illustrates very clearly the correspondence between factor scores and actual markings. A thorough examination of Appendices B and C reveals that the correspondence between factor scores and fitness report markings holds throughout the set of data and

indicates that the three factors do, indeed, contain most of the essential information of the original 18 variables.

B. ANALYSIS OF SUBSETS OF THE DATA

During this phase of the analysis, the original data was separated into the following eight subsets: one for each of the six ranks, one for Company Grade Officers, and one for Field Grade Officers. The subsets were then analyzed by the same procedures that were used for the complete set. Each subset factored into three factors, as before. The factor loadings, communalities, and factor scores changed, but the composition of the factors remained relatively constant throughout. In no case did the proportion of total variance accounted for by the three factors fall below 70%. In short, there seemed to be no significant difference in factor structure between any of the groups (including the complete data set) studied. In view of this finding, it seemed neither necessary nor worthwhile to reproduce the tables for each of the subsets of data.

One significant difference between the groups was, however, revealed during this phase of the analysis. That difference concerns the means of the markings on the various variables and is clearly visible in Table VII. The values in the table are the arithmetic means of the values in Appendix B for the groups indicated. The last column of Table VII, titled "All", is the mean of all values of the specified variable. The last row, titled "Group", shows the means for

Table VII. Means of the Marks

Var #	Second Lt	First Lt	Capt	Major	LtCol	Col	Co Grade	Field Grade	All
1	3826	3599	3907	4029	4133	4545	3798	4198	3996
2	3599	3293	3644	3857	3926	4199	3525	3969	3745
3	3597	3327	3772	3790	4096	4254	3610	4008	3807
4	3690	3555	3900	3942	4143	4236	3767	4082	3923
5	3717	3613	3835	3947	4094	4352	3751	4100	3924
6	4138	3940	3981	3991	4064	4147	3982	4055	4018
7	3898	3724	4040	4050	4260	4391	3923	4205	4063
8	4031	3889	4208	4325	4418	4700	4087	4453	4268
9	4410	4003	4256	4251	4439	4545	4187	4387	4286
10	3802	3683	4060	4170	4228	4528	3912	4282	4096
11	3421	3357	3700	3804	3936	4340	3562	3987	3772
12	3439	3356	3857	3882	4099	4392	3653	4084	3867
13	3792	3536	3925	3942	4167	4450	3785	4146	3964
14	4411	4409	4592	4722	4713	4756	4515	4728	4620
15	4053	3884	4059	4114	4315	4509	4001	4281	4140
16	3645	3562	3785	3934	4096	4365	3699	4098	3896
17	4043	3895	4095	4066	4215	4366	4025	4191	4107
18	3865	3730	3962	4013	4193	4436	3877	4181	4027
Group	3857	3686	3977	4046	4196	4417	3870	4191	4029

each of the indicated groups for all variables. Two facts stand out from this table:

1. The mean marking for Second Lieutenant is higher than the corresponding marking for First Lieutenant in every case.

2. The mean markings increase by rank from First Lieutenant in all but three cases, and the magnitude of the three reversals is very small.

The trend indicated by paragraph (2) above is largely predictable, since it is assumed that only the "most qualified" individuals are promoted. The meaning of the reversal of this trend by First/Second Lieutenants is less clear, however. One possible explanation is that Second Lieutenants, being largely young and inexperienced, are not judged by the same standard as others--i.e., not as much is expected of them.

One other point from this table is worthy of mention. The mean marking for variable 14, Loyalty, is consistently higher than all others for each group and for the sample as a whole. This indicates either that all Marine Officers are very loyal or that reporting officers are ill-disposed to indicate otherwise. Considering the meaning which might be attached to a low marking on this variable (e.g., disloyalty), the latter is undoubtedly the case.

Table VIII shows the standard deviations of the markings by variable and by sub-group. The last column gives the standard deviation of all marks for the given variable, while

Table VIII. Standard Deviations of the Marks

Var #	Second Lt	First Lt	Capt	Major	LtCol	Col	Co Grade	Field Grade	All
1	569	449	545	474	499	363	534	501	555
2	729	588	586	562	560	461	620	552	627
3	528	507	519	596	483	531	552	578	598
4	681	595	597	549	501	743	622	604	632
5	483	537	568	533	543	540	558	560	584
6	802	605	614	782	666	741	630	736	684
7	687	553	592	642	508	626	604	613	624
8	710	627	552	468	484	230	608	449	566
9	429	603	503	488	385	331	547	436	504
10	564	609	586	523	529	402	615	515	596
11	641	591	572	535	570	402	598	558	616
12	484	561	594	551	574	454	620	571	633
13	715	566	582	531	526	492	613	556	613
14	657	483	305	211	252	176	419	216	351
15	628	562	537	542	455	351	557	496	545
16	409	468	509	455	477	398	496	478	526
17	749	550	593	601	565	575	600	593	601
18	706	446	547	465	463	415	541	481	534
Group	690	617	596	580	541	506	624	567	617

the last row gives the standard deviation for each of the sub-groups and is calculated as follows (11):

$$S_T = \sqrt{M_{S^2} + S_M^2}$$

where, for each of the sub-groups, M_{S^2} is the mean of the variances of the variables and S_M^2 is the variance of their means.

The main point to be learned from Table VIII is that the total dispersion of marks decreases as rank increases, although there is no clear trend for any specific variable. This means that the markings for higher ranks are not only better (higher) in the average than for lower ranks (with the exception pointed out above), but also that they are more consistent. It would not be true, however, to say that the variance (square of the standard deviation) decreases to the point where there is an insignificant difference between the marks for the higher ranks. Since the marks on the fitness reports are used for promotion and retention purposes, variance is essential for the proper execution of such decisions. It appears from the data that even though the variance decreases, it remains sufficient, even in the higher ranks, to satisfy the needs of the system by providing a basis for selection.

VI. CONCLUSION

If personnel performance is important to an organization, it follows that performance evaluation is also important. It is not sufficient, however, simply to have a functioning system for the evaluation of performance. It is essential that the system be both effective and efficient. The system currently employed by the Marine Corps is apparently effective--in the sense that it fulfills its objectives to the satisfaction of its users. The question raised and examined in this study concerns not the effectiveness, but the efficiency of the system. Does the Marine Corps Fitness Report provide the necessary information in the most efficient way? Based on the analytic results presented earlier, it apparently does not.

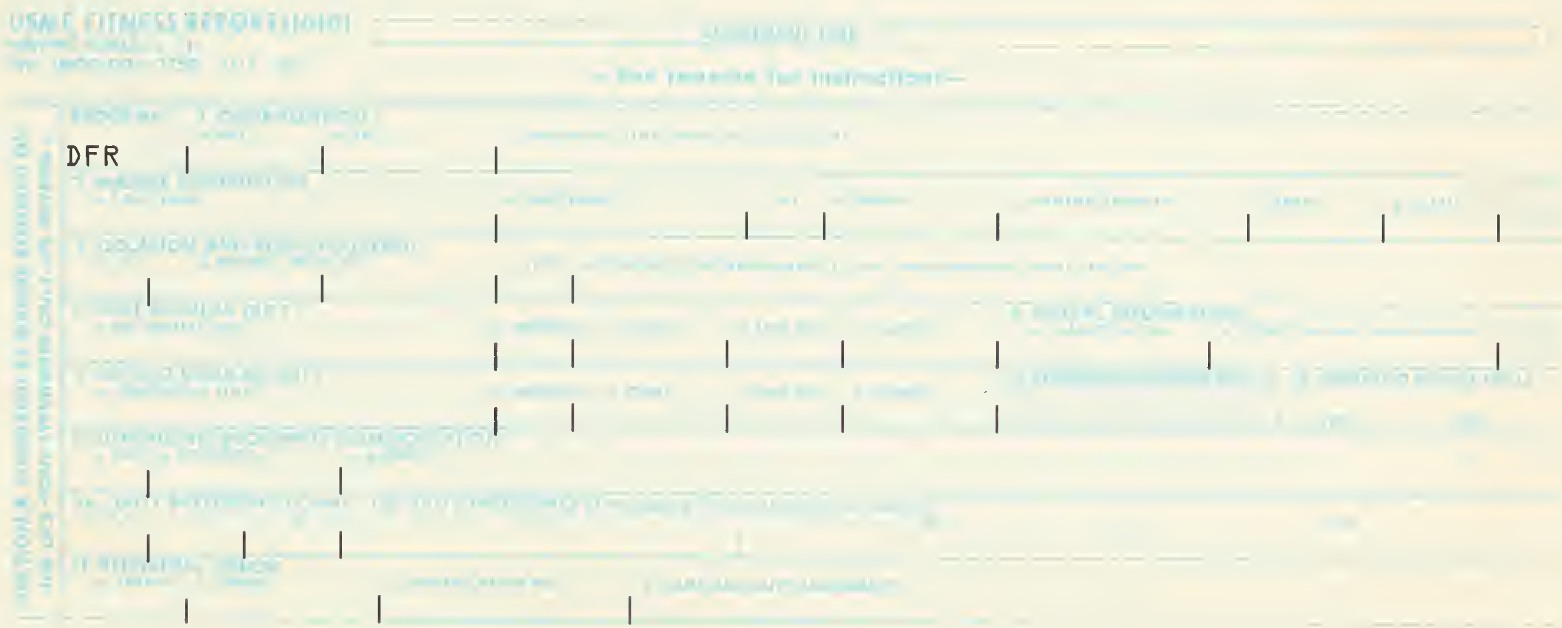
The 18 behavioral dimensions examined in this study undoubtedly contain information which is vital to the needs of the Marine Corps, but nearly three-quarters of this information could be acquired by asking only three questions, rather than 18, about the individual being evaluated. As is frequently the case, there is a necessary trade-off between completeness and efficiency. More information can be acquired by asking 18 questions than by asking three. And still more could be acquired from 20, 30, or 50 questions. But the larger reports are undoubtedly less efficient, since there is a limit to the amount of useful and relevant information that can be acquired.

The question to be answered, then, not by this paper but by the appropriate policy-makers, is: How much information is enough? If the amount of information contained in the three factors proposed by this study is not sufficient, then additional factors should be introduced. The additional factors should correspond to those variables with low factor loadings on the three common factors, since they are the ones least represented by the common factors.

The ultimate decision in this matter, however, depends on the needs and objectives of the system. The three factors hypothesized by this study appear adequate to satisfy those objectives, as they have been previously defined. The three factors can provide an evaluation of duties performed; they can provide a comprehensive portrayal of the professional qualifications, personal traits and characteristics, and potential of the individual; and they can provide a basis for determining duty assignments and promotional qualifications. And they can do all this faster and more easily than is possible in the existing system.

APPENDIX A. THE MARINE CORPS FITNESS REPORT

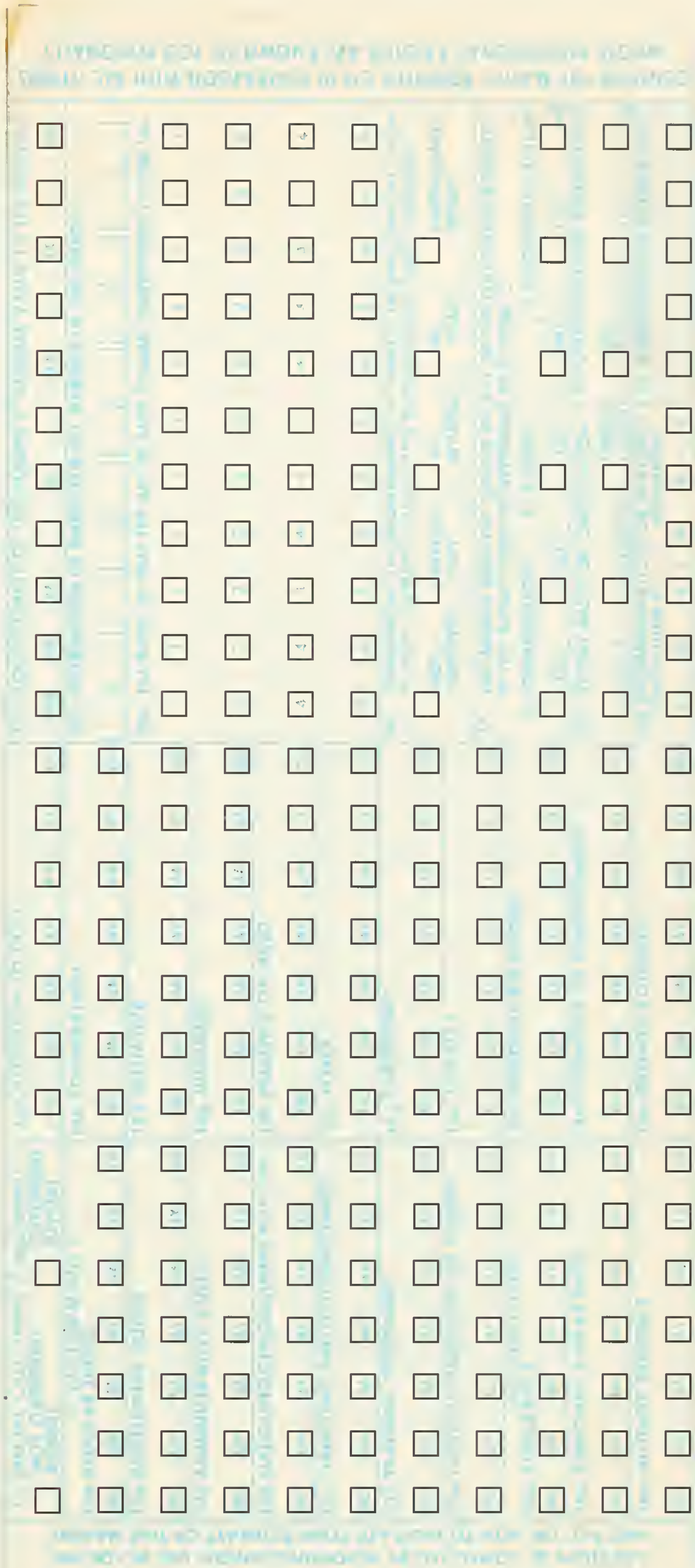
Section A.


USMC FITNESS REPORT

DFR

— See reverse for instructions —

Section B.



Sections C and D.

APPENDIX B. MATRIX OF MARKINGS

CASE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0001	3412	3412	3412	4839	3412	4839	4839	3412	4839	4839	3412	3412	3412	4839	4839	3412	3412	4126
0002	4363	3888	3412	3940	3888	4839	4554	4268	4554	4554	4268	4014	4554	4839	4554	3888	4839	4601
0003	4411	4411	3769	4126	3983	4411	4126	4696	4839	4126	3840	3697	4411	4839	4696	3840	4411	4483
0004	3412	3412	3412	3412	3412	4839	3412	3412	4839	3412	3412	3412	3412	4839	4839	3412	4839	3412
0005	4126	4126	4839	4839	4126	4126	4839	4839	4126	4126	4126	3412	4126	4839	4839	4126	4126	4483
0006	4205	3412	3412	3729	3590	4839	3888	4522	4680	4046	3412	3412	3729	4680	3590	3412	3888	4126
0007	4126	4839	3412	4126	4126	4839	4839	4839	4839	4126	3412	4126	4126	4839	4126	4839	4839	4483
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0281	3650	3729	2989	2565	3412	2331	3443	3729	3983	3729	3412	3158	3697	4554	4268	4268	3189	3047
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0283	4126	4839	2142	2142	3888	3983	3983	4839	3983	4839	3983	4554	2989	4839	2776	4839	3983	4268
0284	4696	4205	4482	3412	4024	3840	4411	4839	4696	4554	4696	4268	4126	4839	4268	4411	4411	4364
0285	4411	4268	3983	3840	4363	4839	4839	4696	4126	4696	3840	4126	4411	4839	3840	3555	4554	4625
0286	4126	4126	3412	4482	4482	4839	4839	3769	3769	4482	3412	4839	4839	4839	4126	3412	4839	4483
0287	4661	4126	3769	4304	4839	3947	4482	4839	4126	4839	4304	3947	4304	4839	4304	4304	4126	4304
0288	3412	3200	3412	3412	3412	3095	2989	3888	3769	3650	3095	3425	3271	4839	3306	3412	3200	3693
0289	3661	3231	3412	3842	4152	3820	4431	4046	4227	3808	3049	4024	3661	4431	3865	3616	3253	3741
0290	3888	3888	4363	3888	3888	4363	4839	4363	4363	4363	4363	3888	3888	3888	3412	3888	4839	4126
0291	3728	3457	3676	4126	4126	4024	3457	3932	3932	4046	2937	4046	3728	4136	3842	3888	3842	3626
0292	3412	3697	3412	4126	3412	3697	3983	3412	4554	3412	3412	2904	3158	4839	4268	3983	3412	3571
0293	2644	2466	2998	2998	2998	4363	4363	2594	3018	3200	2806	2856	2856	3781	3067	3067	2856	2937
0294	4205	3888	4046	4363	4601	3729	3888	4680	4522	3888	3412	4205	4227	4839	4046	3888	3888	4284
0295	3570	3288	3571	3650	4839	3130	3764	3588	4522	3288	3130	3288	3447	4522	4522	3429	3288	3610
0296	3713	3432	4126	4024	3983	4363	4363	3747	4064	3788	3547	3788	3788	4839	4205	4126	4205	3848
0297	4680	4839	4363	4363	4431	4839	4680	4680	4205	4680	4680	4839	4522	4839	4205	4522	4839	4760
0298	3616	3049	3888	3412	3769	3616	3616	3638	4024	3231	2868	2686	3412	4839	4024	3616	3412	3412
0299	3888	3429	3967	4126	4839	3905	4205	4680	4222	4522	4046	4363	4064	4839	3923	4363	4046	4126
0300	4696	4126	4024	4024	3697	4554	4554	4839	4126	4268	3983	4126	4268	4696	4268	4126	4268	4450

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0301	4839	4839	4661	3412	4839	4126	4304	4839	4839	4839	4839	4839	4839	4839	4482	4304	4839	4839
0302	3095	3451	4165	3661	3412	3769	3630	4304	3630	3986	4165	3947	3630	3769	3808	3808	3986	3808
0303	3983	3443	4268	4554	3808	2236	3729	4014	4554	3983	4268	4268	4268	4554	4554	4126	3729	3713
0304	4635	4635	4839	4839	4839	4635	4839	4839	4839	4635	4635	4839	4839	4839	4839	4839	4635	4635
0305	4024	3888	3650	3769	4126	3650	3650	4839	4363	3888	3676	3412	3888	4839	3914	4363	4126	4024
0306	3769	3788	3947	3947	4126	3273	3273	3769	4126	3610	3590	3947	4126	4661	3769	3412	3590	3769
0307	4661	4554	4839	4554	4363	4661	3947	4839	4839	4661	3947	4304	4839	4839	4839	4839	4839	4661
0308	4839	4635	4431	4431	4431	4068	4635	4839	4431	4839	4431	4839	4431	4839	4250	4431	4250	4533
0309	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839
0310	4304	3842	4431	4839	4024	4839	4839	4839	4431	4431	4024	4431	4839	4839	4839	4024	4839	4483
0311	4635	4635	4635	4635	4554	4431	4635	4635	4839	4635	4635	4635	4839	4839	4839	4635	4839	4635
0312	4839	4024	4839	4839	4839	4635	4635	4839	4635	4635	4635	4024	4839	4839	4839	4839	4839	4839
0313	4126	4126	4304	4482	4024	3590	4304	4839	4661	4482	3432	3769	4304	4839	3947	3983	4324	4215
0314	4268	4268	4268	4839	4839	4268	4014	4268	4839	4268	4839	4268	4268	4839	4839	4268	4268	4411
0315	3888	3888	4046	4046	3888	4680	4363	4680	4522	4363	3729	3729	3888	4839	4839	4661	3888	4126
0316	4431	4431	4431	4554	4482	3820	4431	4839	4431	4431	4227	4024	4431	4635	4635	4227	4431	4635
0317	3412	3590	3769	3412	3412	3412	3947	4126	4304	4126	4126	3412	3769	4839	4126	3412	3769	3680
0318	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839
0319	4024	3049	4046	4024	4126	4024	4635	4227	4024	4635	3434	4431	4024	4635	4431	3638	4024	4024
0320	4680	3888	4839	4839	4839	4839	4839	4680	4839	4839	4680	4839	4839	4839	4839	4046	4839	4680
0321	3158	3095	3769	4126	3412	3412	3095	3451	4126	3095	3095	3451	3095	4839	4482	3769	3095	3610
0322	4431	4024	4431	4227	4126	4227	4227	4431	4227	4431	3616	4431	4431	4431	4024	3616	4635	4126
0323	4363	4152	3888	3412	3412	4601	4601	4363	4126	4363	3438	4126	4126	4839	4126	3650	4363	4364
0324	4554	4126	4836	4839	4227	4554	4696	4696	4554	4554	4554	4268	4680	4839	4268	4680	4554	4276
0325	4482	4482	4482	4126	3412	4661	4839	4839	4661	4661	4482	4839	4482	4839	4661	4126	4482	4572
0326	3412	2904	4554	4482	3769	3983	4268	4268	4554	3158	3412	3412	3983	4839	3983	3412	3983	3983
0327	4522	4482	4126	4126	4126	4522	4522	4522	4839	4522	4522	4227	4363	4839	4839	4554	4839	4522
0328	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4363	4839	4839
0329	3815	3253	3412	3158	3610	2617	2777	3999	3999	3031	2824	2777	2904	4554	3570	3158	3078	3095
0330	3671	4126	4126	3983	4839	3872	3856	4554	4839	4411	3840	4268	3888	4839	4411	4126	4126	4126
0331	3888	4363	3769	4126	4839	3412	3888	4125	4363	4601	3888	4152	4363	4363	4363	4839	4363	4245
0332	3888	3457	3967	4227	4126	3947	3769	4126	4661	3788	3788	3769	3947	4661	4482	3820	3610	3306
0333	3571	3729	2936	3412	3412	2565	3412	3729	3571	4363	3412	4839	3590	4839	3571	3571	3571	3650
0334	3888	2794	4126	4227	3888	3840	3840	3619	3840	3191	3334	3697	4126	4460	4268	3447	3999	3817
0335	3888	3888	3412	3412	3412	3301	3713	4554	4411	4411	3428	4696	3412	4839	3840	4268	4268	3888
0336	4482	3983	3590	3697	3412	4661	4839	4839	4126	4661	4661	3947	4839	4839	4482	4482	4839	4393
0337	4227	4431	4363	4839	4363	4024	4635	4839	4839	4839	3820	4839	4635	4839	4431	4227	3616	4431
0338	4126	4268	3729	4046	3412	4126	4411	4411	4268	3840	3697	4205	3888	4839	4363	3729	3729	4268
0339	4635	3729	3650	3888	3888	3888	4839	4635	4839	4839	4126	4839	4839	4839	4046	3888	4839	4720
0340	3983	3412	3697	4268	3697	3412	3555	4554	4411	3840	3840	3443	4268	4554	4411	3412	3983	3912
0341	4024	3412	3616	4126	4268	4635	4227	4227	4024	3412	3412	3616	4126	4635	3412	3412	2820	3922
0342	3412	3883	3412	3412	3412	4304	4304	4126	4126	4126	3412	3947	3947	4661	3769	3888	4304	3769
0343	4839	3769	4363	3769	4839	4839	4839	4839	4839	4126	4482	3769	4482	4839	4839	4482	4839	4839
0344	3983	4554	3412	4126	3412	4268	3983	3983	4554	4268	3697	4268	3697	4554	4554	4554	4839	4269
0345	4126	4411	4554	4661	4635	4696	4696	4839	4839	4411	4268	4411	4554	4839	4839	4696	4696	4483
0346	4431	4126	4227	4363	4268	4635	4839	4839	4839	4431	4227	3820	4635	4839	4839	3650	4839	4635
0347	4227	4024	4024	4431	3769	3412	4635	4839	4635	4839	4024	4431	3820	4839	4839	4635	4635	4635
0348	4363	3412	4363	4839	3412	2142	4363	4839	4839	4839	3412	4839	4363	4839	3412	4363	4363	4601
0349	4554	4482	4482	3412	4839	4839	4482	4482	4839	4482	4482	3412	4126	4839	4839	4126	3769	4126
0350	4190	4126	3840	4411	4126	4839	4696	4839	4839	4411	4126	4268	4554	4839	4268	4696	4696	4411

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0352	4635	3820	4227	4363	4227	3117	4340	4839	4635	4839	4839	4839	4635	4839	4635	4839	4227	4431
0353	4839	4601	4363	4554	4554	4601	4601	4601	4839	4363	4601	4126	4601	4839	4839	4839	4126	4411
0354	4839	4839	4601	4839	4839	4431	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839
0355	4502	4839	4431	4431	4431	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839	4839
0356	4205	4002	3114	3697	3769	2228	2647	4075	3757	4064	4205	4304	3412	4427	3743	4126	3428	3873
0357	4680	4363	3769	3412	3412	3571	3729	4839	4839	4205	3888	3729	4304	4839	4839	4205	3729	4126
0358	4190	3555	3931	4190	4205	3931	4190	4709	4580	4580	4075	4580	4190	4839	4709	4320	4190	4385
0359	4709	4061	4709	4696	4839	4450	4709	4839	4580	4839	4450	4839	4709	4839	4450	4190	4580	4696
0360	4554	3983	4268	4268	4839	4839	4839	4839	4839	4839	4268	4554	4839	4839	4554	4554	4554	4554
0361	4839	4126	4839	4839	4839	4601	4839	4839	4839	4363	4839	4126	4839	4839	4839	4601	4363	4601
0362	4339	3983	4839	4839	4839	4839	4839	4554	4268	4839	4554	4554	4839	4268	4554	3697	4554	4696
0363	4680	3571	3888	3820	4839	4363	4205	4680	4522	4522	3888	4304	4680	4839	4522	4205	4522	4522
0364	4839	4482	4482	4363	4839	4834	4839	4839	4839	4839	4482	4482	4839	4839	4839	4126	4482	4661
0365	4635	3650	4635	4126	4363	3638	3820	4839	4431	4431	4431	4024	4227	4635	4635	3412	3820	4330
0366	4431	4431	4839	4839	4839	4431	4839	4635	4839	4635	4431	4839	4839	4839	4839	4635	4839	4737
0367	3438	3412	2777	2989	2777	1382	1776	4363	4363	3200	3200	3200	2565	4839	4252	4126	2250	2619
0368	4839	4839	4839	4839	4839	4601	4839	4839	4601	4839	4601	4839	4839	4839	4601	4839	4601	4601
0369	4839	4173	4363	4227	4320	4078	4554	4839	4363	4363	4268	4458	4679	4839	4078	4679	4679	4411
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0373	4839	4126	4661	4839	4839	4839	4661	4661	4482	4661	4482	4839	4661	4839	4661	4482	4839	4839
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0385	4363	3888	4363	4126	3769	3464	4363	4601	4601	4126	4126	3650	4363	4363	4363	4363	4363	4363
0386	4839	4126	4661	4661	4839	4839	4839	4661	4661	4839	4661	4839	4661	4502	4661	4839	4661	4750
0387	4839	3412	3947	4268	3888	4304	4661	4839	4661	4661	3947	4482	3947	4839	4482	4304	4482	4572
0388	4839	3729	4126	4431	3820	4046	4363	4839	4839	4839	4680	4839	4839	4839	4839	4126	4839	4601
0389	4431	3650	4839	4601	4839	4601	4363	4839	4601	3888	3650	4363	4839	4363	4839	3983	4601	4483
0390	4411	3888	4205	4046	4635	4064	4680	4839	4363	4839	4680	4839	4522	4839	4680	4205	4680	4522
0391	4839	4839	3769	4661	4554	3769	4482	4839	4126	4839	4482	4126	4661	4839	3947	4661	4839	4661
0392	3888	4601	4126	3412	3412	4839	4839	4839	4363	3412	4601	3888	4363	4363	4839	4601	3412	4007
0393	4126	4363	3412	4839	4126	4482	4482	4839	4839	4363	4363	4363	4363	4839	4839	4363	4363	4304
0394	4601	4268	3412	3412	4482	4601	4839	4839	4601	4363	3888	4601	4601	4839	4363	4601	3412	4245
0395	4839	4839	4339	4839	3412	3842	4024	4839	4839	4839	4839	4482	4601	4839	4431	4661	4839	4572
0396	4839	4431	4227	4839	4635	4635	4839	4839	4839	4839	4635	4839	4635	4839	4227	4635	4839	4839
0397	3412	4126	4126	0273	3412	4126	3412	4126	4126	4126	3412	3412	3412	4126	4126	4126	2777	3412
0398	4661	3888	3933	3840	3840	4320	4450	4709	3542	4320	4061	4580	4190	4709	3801	3555	4320	4061
0399	4363	4601	4601	4554	4268	3412	3412	4839	4839	4839	3888	4601	4363	4839	4650	4363	4650	4007
0400	4839	4431	4268	4839	4363	3820	4635	4635	4839	4635	4363	4363	4554	4839	4635	4554	4431	4228
0401	4661	4839	4482	4554	4839	4839	4635	4635	4839	4635	4024	4024	4431	4839	4839	4268	4431	4330
0402	4250	3638	4046	4263	4482	2209	3117	4227	4635	4250	4046	3638	3638	4839	4431	3842	3231	3831
0403	4839	4304	4661	4304	4839	4482	4829	4839	4482	4839	4304	4839	4839	4839	4304	4126	4839	4839
0404	4839	3697	4839	4839	4839	4839	4839	4839	3697	4839	4839	4839	4839	4839	4268	4839	4839	4839

APPENDIX C. FACTOR SCORES

FACTOR SCORES

CASE			
1	-1.77957	1.18469	1.46219
2	-0.16356	1.24057	0.46400
3	-0.28383	0.33257	1.29983
4	-2.33450	1.42685	1.55737
5	0.03053	0.57227	0.35006
6	-0.90217	0.66169	0.29043
7	0.14946	0.32552	0.57894
8	-0.77845	-0.21540	-0.13920
9	-0.79364	-3.31542	-0.35705
10	-0.76952	0.32471	-2.41077
11	-0.46755	-0.40121	-1.52031
12	-0.15242	-0.21228	-1.42339
13	-0.37777	-0.34420	0.03247
14	-0.79425	0.05136	0.59610
15	-1.31650	0.79114	-2.14822
16	0.23357	1.42273	-0.39671
17	-0.13342	1.39525	0.21345
18	-1.41250	1.27307	1.53293
19	-0.92622	-0.11458	-0.67547
20	-1.56937	0.31966	1.24553
21	-1.61357	0.35702	-2.17659
22	-1.59179	-1.19285	0.21233
23	-1.52280	0.17214	-0.63118
24	-1.00210	-0.61570	0.77250
25	-0.43027	-1.21570	0.25363
26	-0.39357	0.49553	-3.77413
27	1.33031	-0.66724	0.90525
28	-2.19774	-0.22335	-2.22934
29	-1.69961	-0.65933	1.55550
30	0.69589	-0.76653	-3.33325
31	-1.23628	1.49755	-0.25339
32	-0.12561	-0.65835	0.51536
33	-0.73177	1.15540	0.14873
34	-1.71126	0.37737	-0.75652
35	-1.51544	-0.21690	1.55844
36	-0.23755	1.20102	-1.00277
37	-0.54932	0.20541	-2.07460
38	-1.19623	1.79532	1.21902
39	-1.07324	0.51444	-0.94812
40	-1.51038	-0.44762	0.37962
41	-1.42172	-0.77602	-1.30505
42	-0.33887	0.09220	-0.30874
43	-0.97635	0.02302	-0.06041
44	-1.72626	0.06742	-0.46850
45	1.57046	1.13224	-1.17556
46	-1.32364	0.05610	-0.61871
47	-1.53332	0.75571	-2.54174
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49	0.59581	-0.24112	0.20524
50	-0.41504	0.03567	-2.84559

51	0.42679	-1.39975	-0.00845
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53	-1.20935	0.97723	0.68304
54	-0.39795	-0.23764	-2.34233
55	-1.72417	0.44779	-0.40361
56	-0.69955	-1.09069	-2.12986
57	-2.09376	0.02672	0.57759
58	-0.71666	1.77661	-0.65821
59	0.44543	-0.02222	-2.73213
60	-0.64682	0.41454	1.28509
61	0.37545	-0.08743	0.00176
62	0.25965	-0.42353	0.51213
63	-1.53472	-0.65314	-0.52556
64	0.63365	0.12062	-0.25935
65	-1.33342	-0.71292	0.25427
66	-0.35341	-0.91174	-0.92541
67	-0.38180	1.58527	0.74209
68	-1.24411	-0.54473	-2.81873
69	0.36234	1.02723	-0.49915
70	-2.99548	1.11930	1.19362
71	-0.45775	0.38035	-2.74475
72	-0.43794	0.64325	0.80613
73	-0.21930	-0.94372	-0.18321
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76	-0.09731	-1.29112	0.51975
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80	0.07462	-2.44255	1.26761
81	0.19797	-0.02244	-1.73347
82	-0.35814	0.74703	-0.36139
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302	0.44992	-0.09763	-1.77923
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315	-0.32632	0.29511	1.17056
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403	1.52574	0.82135	-0.30536
404	2.03644	1.14242	-1.24541

BIBLIOGRAPHY

1. Cooley, W. W. and Lohnes, P. R., Multivariate Data Analysis, Wiley, 1971.

2. Fleishman, E., Harris, E. F., and Burtt, R. D., Leadership and Supervision in Industry, Ohio State University Press, 1955.

3. Fruchter, B., Introduction to Factor Analysis, D. van Nostrand, 1954.

4. Harmon, H. H., Modern Factor Analysis, University of Chicago Press, 1960.

5. Huse, E. F. "Performance Appraisal--A New Look," Personnel Administration, v. 30, p. 13-18, April 1967.

6. Kaiser, H. F., "The Varimax Criterion for Analytical Rotation in Factor Analysis," Psychometrika, v. 23, p. 187-200, 1958.

7. Lathrop, R. G., Introduction to Psychological Research, Harper, 1969.

8. Morrison, D. F., Multivariate Statistical Methods, McGraw-Hill, 1967.

9. Schoeninger, D. W. and Insko, C. A., Statistics for the Behavioral Sciences, Allyn and Bacon, 1971.

10. Thurstone, L. L., Multiple-Factor Analysis, A Development and Expansion of the Vectors of the Mind, University of Chicago Press, 1947.

11. Weitzman, R. A., Statistics: Why and How, McGraw-Hill (manuscript, to be published during 1977).

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A factor analysis of the behavioral dimensions of Marine performance evaluation.