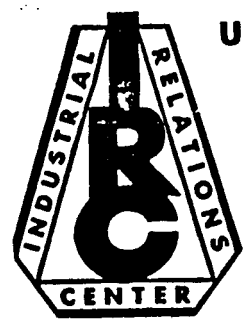

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The Measurement of Employment Satisfactoriness

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Table of Contents

The Measurement of Employment Satisfactoriness

Summary

This study was undertaken to develop criterion measures of employment satisfactoriness, to examine satisfactoriness among physically handicapped workers (as compared with non-handicapped workers), and to determine the relationship between satisfactoriness and satisfaction. The samples consisted of 483 physically handicapped persons and 496 "controls" (non-handicapped co-workers of the physically handicapped workers), grouped into four occupational categories; nonskilled blue-collar, skilled blue-collar, nonskilled white-collar, skilled white-collar. The instruments used for data collection were an Alternation Ranking Form, a Supervisor Evaluation Form, and a Personnel Records Questionnaire. These were designed to obtain data on quality of work, quantity of work, attendance, lateness, accidents, disciplinary actions, job suitability, promotability and recommendation for a pay raise.

The analysis proceeded as follows:

1. Mean item score differences between handicapped and control groups, between skilled and nonskilled groups, and between blue-collar and white-collar groups were tested for statistical significance using an analysis of variance method.

2. For each group, an item intercorrelation matrix was computed and factor analyzed. The factor-analytic results were then utilized to develop scales for measuring the components of satisfactoriness. Hoyt reliability coefficients were computed for all scales.

3. Mean scale score differences between handicapped and control, skilled and nonskilled, blue- and white-collar groups were tested for statistical significance, using an analysis of variance method.

4. For each group, a scale intercorrelation matrix was computed using the satisfactoriness and satisfaction scales as the variables. Each correlation matrix was factor analyzed. The canonical correlation between the set of satisfactoriness measures

and the set of satisfaction measures was determined for each group.

Following are the principal findings of this study:

1. The handicapped workers compared favorably with their control counterparts on all but two items: overall ranking and quality of work performed. On these items they were rated significantly lower.

2. The skilled workers were rated higher than the nonskilled workers on job suitability, but were rated lower on absences and lateness. The white-collar workers were rated higher than the blue-collar workers on disciplinary actions, quality of work, promotability, and recommendation for pay raise. On all other items, the groups being contrasted obtained comparable ratings.

3. Satisfactoriness was organized in similar fashion for all eight groups. For each group, satisfactoriness had two components: performance and conformance-to-rules. "Performance" was indicated by five items: alternation ranking, quality of work, promotability, recommendation for pay raise and the Heron adjustment criterion. "Conformance-to-rules" was reflected in items on absences, lateness, and accidents. Scales were developed to measure these two components of satisfactoriness for each group. These scales had reliability coefficients ranging from .76 to .85. Median correlation between "performance" and "conformance-to-rules" was .44.

4. Analysis of variance using scale scores showed that handicapped workers were rated as favorably as their control counterparts; skilled workers were rated higher than nonskilled workers on both "performance" and "conformance-to-rules"; and white-collar workers were rated higher than blue-collar workers on "performance."

5. Factor analysis of the matrices which included both the satisfactoriness and the satisfaction measures showed the satisfactoriness measures loading on one factor and the satisfaction measures loading on another. This finding indicates that the satisfactoriness measures and the satisfaction measures were operationally independent. This independent relationship was

confirmed by the low canonical correlation coefficients obtained between the set of satisfactoriness measures and the set of satisfaction measures.

Administration, scoring, and norms for the satisfactoriness instruments are discussed in the final section.

Introduction

The definition and measurement of criteria for work adjustment is the main focus of the core research program being conducted by the Region VI Regional Vocational Rehabilitation Research Institute. Bulletin X in the **Minnesota Studies in Vocational Rehabilitation** series has detailed the selection of criterion variables for inclusion in the study. For purposes of analysis, these variables have been categorized into three sets, namely: satisfaction, satisfactoriness, and work history.

"Satisfaction" consists of those variables which represent the individual's view of his "work adjustment." These variables reflect the individual's evaluation of his work situation in terms of how satisfied he is with the many aspects of work, e.g., the type of work activity he engages in, the people he works for and with, the conditions under which he works, the compensation he receives for his work. These variables might then be considered as reflecting the extent to which the individual's expectations concerning work have been fulfilled.

"Satisfactoriness" includes those variables which represent the employer's view of the individual's "work adjustment." The employer presumably is concerned with the individual primarily as an employee. That is, the employer views the individual's "work adjustment" mainly in terms of how well he performs his job. Thus, the employer's view provides an organizational criterion while the individual's view represents an individual criterion.

"Satisfaction" and "satisfactoriness" are therefore separate, although not unrelated, classes of criteria. To be meaningful, they must refer specifically to one particular job of the individual. That is to say, "satisfaction" should more accurately read "satisfaction-with-this-job" and "satisfactoriness" should be "satisfactoriness-on-this-job." To be even more precise, "satisfaction" and "satisfactoriness" should refer to a specific time-point during the individual's tenure on the job. The pattern of satisfaction-satisfactoriness on one job indicates "job adjustment," while the pattern of satisfaction-satisfactoriness over all jobs reflects "work adjustment." Thus, the concept of "job adjustment" may be advanced as distinct from, but part of, "work adjustment."

"Satisfaction" and "satisfactoriness" are evaluative criteria. As such, employment decisions and actions may result from them. Promotions, transfers, quits and firings are examples of such de-

cisions and actions. Patterns of these decisions and actions in the work history of the individual are significant indicators of work adjustment. So are patterns of job progression, job tenure, and unemployment. These variables are **behavioral**, in contrast to the evaluative criteria of "satisfaction" and "satisfactoriness." They consist of behaviors which can be objectively observed and recorded. Because these behavioral variables are also those commonly derived by vocational counselors from work history information, they have been categorized as the "work history" set of work adjustment criteria.

The measurement of those variables which constitute "satisfaction" was the subject of Bulletin XIII of the present series. The present bulletin (Bulletin XIV) reports on the measurement of the variables constituting "satisfactoriness" and the combination of "satisfaction" and "satisfactoriness" into "job adjustment." A subsequent bulletin will report on "work history" and its relation to "satisfaction" and "satisfactoriness."

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The concept of "satisfactoriness" arises out of the fact that employers and employing organizations have certain goals, the attainment of which requires the coordinated performance of groups of people. To insure the proper coordination of these groups, the total required performance is broken up into sets of tasks, one set for each employee, and rules are promulgated to govern the performance of each set of tasks in relation to the performance of all other sets of tasks. In time, similar sets of tasks and similar sets of rules are standardized, i.e., become "standard" for most employing organizations. This standardization permits the employing organization to evaluate each employee in terms of some desired standard of performance or in terms of comparison with the performance of other employees, past or present, on the same set of tasks. This evaluation constitutes the "satisfactoriness" of the employee.

In other words, from the standpoint of "satisfactoriness," the work environment of the individual is defined by the series of tasks which he must perform and the set of rules to which he must submit. The behavior of the individual within this "environment" is the basis for the "satisfactoriness" evaluations.

In a sense, when hiring an individual, the employing organization really "pays" for a standardized set of work behaviors. "Satis-

factoriness" has more direct reference to the standardized set of work behaviors required of the employee than to the contribution of the employee toward the attainment of the employing organization's goals. Systematic methods for measuring the individual's contribution toward the attainment of the employer's goals have not as yet been developed.

This bulletin deals with the problem of measuring "satisfactoriness." It also deals with the concept of "job adjustment," that is, the combination of satisfaction and satisfactoriness on a particular job. In addition, as in the preceding bulletin, it is concerned with the effect of two correlate variables, presence of disability and occupation, on the definition and measurement of work adjustment criteria.

Methodology

This section describes the instruments used to obtain "satisfactoriness" data, the procedures by which these data were obtained, and the samples of workers for whom "satisfactoriness" data were obtained.

The Instruments

The literature survey summarized in Bulletin X suggested several kinds of information from the employer that might be used to assess an individual's satisfactoriness. Among these were quality and quantity of work, job suitability, promotability, recommendation for a pay raise, absences, lateness, accidents, and disciplinary actions. In addition to these specific kinds of information, "satisfactoriness" might be viewed in a general or over-all sense.

The following initial decisions were made relative to the choice of instruments for collecting these different kinds of "satisfactoriness" data:

1. Data on quantity of work would be obtained from production records.
2. Data on absences, lateness, accidents, and disciplinary actions were to be obtained from personnel records.
3. General or overall satisfactoriness would be based on alternation rankings.[1]
4. Data on quality of work, job suitability, promotability and recommendation for a pay raise would be obtained through a Supervisor Evaluation Form.

After several pretests, it became apparent that most firms did not keep the kind of production records or personnel records that would be useful for the purposes of the present study. Accordingly, the Supervisor Evaluation Form was revised and enlarged to obtain data on absences, lateness, accidents and disciplinary actions, in addition to job suitability, quality of work, promotability and recommendation for pay raise. The Form called for the supervisor's

[1] See Appendix A.

evaluation of the individual in comparison with his co-workers or the "satisfactoriness" indicators listed above. As an example:

> Compared to the rest of the men in his group, how much is he absent from work? (Check one)
>
> ☐ much less ☐ less ☐ about average ☐ more ☐ much more

One item was used for each indicator. In addition, Heron's[2] criterion of work adjustment was incorporated into a final item. This consisted of five statements describing varying degrees of work adjustment. The supervisor was to select the statement most descriptive of the employee being evaluated.

"Quantity of work" was left out of the Supervisor Evaluation Form for two reasons: (1) for a large number of jobs (blue-collar production-line jobs as well as white-collar clerical jobs), "quantity of work" could not be practicably defined and measured; (2) where it was meaningful and could be defined and measured, it was still hoped to obtain actual production records as data.

A Personnel Records Questionnaire form was developed to standardize the collection of data from the various personnel departments or personnel managers. Standardization took the form of (1) definitions for absences, tardiness, major and minor accidents, major and minor disciplinary actions, and (2) setting the "base period" as the month preceding the date the form was completed.

A standard alternation ranking form was used in the study. This form instructed the supervisor to evaluate employees on "over-all competence, the effectiveness with which they perform their jobs, their proficiency, their over-all value." The alternation ranking thus represented a general or over-all evaluation of the individual worker in relation to his co-workers.

Copies of the three instruments—the Supervisor Evaluation Form, the Personnel Records Questionnaire and the Alternation Ranking Form, are shown in Appendix A.

Data based on the Personnel Records Questionnaire (i.e., for absences, lateness, accidents, and disciplinary actions) were not obtained for significant portions of all samples in the present study to the extent of preventing the use of such data as were obtained.

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[2] Heron, A. Satisfaction and satisfactoriness: complementary aspects of occupational adjustment. *Occup. Psychol.*, 1954, 28, 140-153.

To permit arithmetic manipulation in the analysis, scoring weights were assigned to the response choices to each item on the Supervisor Evaluation Form. These weights ranged from 5 (for most satisfactory) to 1 (least satisfactory). The alternation rankings were used to divide each work group into "above average" (the uppermost one-fourth of the group), "average" (the middle one-half) and "below average" (the lowermost one-fourth). Weights of 3, 2, and 1 respectively were assigned to these divisions.

To summarize, the instruments described above provided quantitative data on 10 indicators of satisfactoriness. These were: (1) absences; (2) lateness; (3) accidents; (4) disciplinary actions; (5) job suitability; (6) quality of work; (7) promotability; (8) pay raise; (9) Heron's adjustment criterion; and (10) alternation ranking. For each individual, scores of 1 to 5 for the first nine items, and 1 to 3 for the last item, could be obtained. These scores represented the immediate supervisor's evaluation of the individual's "satisfactoriness."

Data Collection:

A detailed description of the data collection procedures utilized in the Work Adjustment Project is available in Bulletin XIII and will not be repeated here. It might be worthwhile, however, to review the portion of the data collection process relevant to "satisfactoriness."

Upon completion of the home interview with the handicapped workers, contact with the employer was initiated within one or two days. The employer was asked to participate in the study of "satisfactoriness" (and **only** this part of the Work Adjustment Project). He was **not** informed that the study concerned handicapped workers or that other kinds of data would be obtained from participating workers. "Satisfactoriness" data on each handicapped worker in the study and his co-workers in the work group were obtained by trained interviewers at the employer's place of business. In most cases, the interviewer obtained the supervisor's evaluations during his visit at the firm. Where this was not possible, the interviewer instructed the supervisor on the completion of forms, leaving blank forms for the supervisor to fill out at a later time. These completed forms were then mailed to the Regional Research Institute. The Personnel Records Questionnaire forms were left with the personnel manager for him to complete and mail to the

Regional Research Institute. Follow-ups were used to insure maximum returns by mail. More than 95% of the forms expected by mail were received.

The Samples:

The sample categories developed in Bulletin XIII were utilized in the analysis of "satisfactoriness." These eight categories were: handicapped and control groups for each of four occupational groups —skilled and nonskilled blue-collar workers, and skilled and nonskilled white-collar workers. Sample sizes are shown in Table 1.

Table 1. Size of sample with "satisfactoriness" data, by group*

Group	N
I. Handicapped, nonskilled blue-collar	163
II. Control, nonskilled blue-collar	185
III. Handicapped, skilled blue-collar	90
IV. Control, skilled blue-collar	111
V. Handicapped, nonskilled white-collar	128
VI. Control, nonskilled white-collar	112
VII. Handicapped, skilled white-collar	102
VIII. Control, skilled white-collar	88

Note: Groups II and IV are larger than the corresponding Groups I and III due to incomplete data for some Group I and III subjects.

* Skill is defined in terms of the amount of formal training required and the degree of control allowed the worker over his work setting. The two categories are:

(a) nonskilled—a position requiring no training beyond public schools, short courses or company in-plant programs. The worker is allowed little or no discretion or control over alternative methods of performing the job;

(b) skilled—a position requiring trade or business school, college, or lengthy apprenticeship training. The worker has some control over his work methods and/or is allowed some individual decisions.

"Collar" is defined in terms of closeness to product or equipment used in production, methods of payment, and actual "dirtiness" of the work. The two categories are:

(a) blue-collar—a position which is non-salaried. The worker works on or delivers the finished product and is required to wear some protective clothing or "work clothes";

(b) white-collar—a position which is usually salaried, is staff, service or clerical in nature, and which is "cleaner" than blue-collar positions.

Sample characteristics, such as sex, age and education distributions, are not reported here inasmuch as these were not changed significantly for the "satisfactoriness" samples from the characteristics reported for the "satisfaction" samples. The interested reader is referred to Bulletin XIII.

Results

Item Analysis

This section concerns the observed item score differences between the handicapped and control groups, between skilled and nonskilled workers, and between blue- and white-collar workers. For each of the 10 satisfactoriness items, the following null hypotheses were tested:

1. The mean score for the handicapped group is equal to the mean score for the control group.
2. The mean score for the skilled workers is equal to the mean score for the nonskilled workers;
3. The mean score for the blue-collar workers is equal to the mean score for the white-collar workers; and,
4. The interaction between the occupational dimension and the handicapped-control dimension is linear and equal to zero. That is, the pattern of the item means for the four occupational groups of handicapped workers is the same as the pattern of the item means for the four occupational groups of control workers.

Means for each of the eight groups were computed for the ten items. Table 2 lists the means, while Appendix B presents the item score distributions.

A "two-way analysis of variance" design was used to test the four hypotheses listed above. One dimension was the handicapped-control dimension, while the other dimension consisted of the four occupational groups (nonskilled blue-collar, skilled blue-collar, nonskilled white-collar, skilled white-collar). Because the number of observations (supervisors' evaluations of workers) in each cell (group) was unequal and disproportionate, an approximation method, that of "unweighted means," was used.[8] This method provided a test of Hypothesis 1 (handicapped vs control) and Hypothesis 4 (interaction). To test Hypothesis 2 (skilled vs nonskilled) and Hypothesis 3 (blue vs white collar), it was necessary to establish

[8] Walker, Helen M., and Lev, J. *Statistical Inference*. New York: Henry Holt, 1953, pp. 381-382.

Table 2. Distribution of item means, by group

Item	Group[a]							
	I	II	III	IV	V	VI	VII	VIII
Absence	3.66	3.63	3.46	3.48	3.58	3.57	3.40	3.48
Lateness	3.73	3.67	3.56	3.50	3.80	3.69	3.53	3.51
Accidents	3.40	3.58	3.30	3.47	3.40	3.44	3.43	3.24
Disciplinary action	3.77	3.86	4.00	3.90	3.96	4.10	3.97	4.11
Job suitability	3.56	3.52	3.69	3.62	3.55	3.59	3.61	3.77
Quality of work	3.32	3.52	3.44	3.52	3.46	3.72	3.52	3.58
Promotability	2.78	2.97	3.06	2.95	3.17	3.36	3.48	3.34
Pay raise	2.64	2.78	2.72	2.74	3.11	3.27	3.27	3.27
Heron adjustment criterion	3.73	3.97	3.92	3.89	3.83	4.04	3.97	4.06
Alternation ranking	1.90	2.13	1.97	2.00	1.93	2.11	2.06	2.10

[a] Group I—Handicapped, nonskilled blue-collar.
Group II—Control, nonskilled blue-collar.
Group III—Handicapped, skilled blue-collar.
Group IV—Control, skilled blue-collar.
Group V—Handicapped, nonskilled white-collar.
Group VI—Control, nonskilled white-collar.
Group VII—Handicapped, skilled white-collar.
Group VIII—Control, skilled white-collar.

two "orthogonal contrasts" within the occupational dimension.[4] The results of these analyses are presented in Appendix C, the significant findings of which are summarized below, grouped according to the hypothesis tested.

Differences between handicapped and control groups. Statistically significant differences (at the .05 probability level or less) between supervisor evaluations of the handicapped and control workers were found on 2 of the 10 items under test.[5] On both items, the control group of workers were evaluated as more satisfactory than the handicapped group of workers. These items were "quality of work" and the alternation ranking.

Differences between skilled and nonskilled groups. Statistically significant differences between supervisor evaluations of the skilled

[4] Cochran, W. G., and Cox, Gertrude M. *Experimental Design*. New York: J. Wiley and Sons, 1950, p. 59.

[5] Statistical significance at the .05 level means that in rejecting the null hypothesis (e.g., that the means for handicapped and control groups are equal), one would reach the wrong conclusion by chance five times or less out of 100 such possible tests on that item. An analogous statement concerning errors of conclusion can be expressed for the .01 level of significance. Which mean is higher or lower is not specified by the statistical test.

and non-skilled workers were found on 3 of the 10 items. On 2 of the 3 items the nonskilled workers were given higher evaluations than the skilled workers. These items were "absences" and "lateness."

On the third item, "job suitability," the skilled workers received higher scores than the nonskilled workers.

Differences between blue- and white-collar groups. Statistically significant differences between supervisor evaluations of the white-collar and blue-collar workers appeared on 4 of the 10 items. On all four items the supervisors of the white-collar workers gave their subordinates higher satisfactoriness scores than did the supervisors of the blue-collar workers. These four items were "disciplinary actions," "quality of work," "promotability," and recommendation for a "pay raise."

None of the items showed a significant interaction effect. The hypothesis that the pattern of the occupational group means for the handicapped workers is the same as that of the occupational group means for the control workers was accepted for each of the ten items.

Three different possibilities may underlie the significant differences observed between groups:

1. The observed difference may represent an actual or true difference between groups;
2. The observed difference may reflect differing standards used by the same supervisor in his evaluations of different workers, i.e., he may be "lenient" in evaluating one worker and "strict" in evaluating another;
3. The observed difference may reflect differing standards used by different supervisors in their evaluations of the workers, i.e., some supervisors may be more "lenient" than others.

In interpreting differences between handicapped and control groups, the third possibility can be eliminated because the same supervisor evaluated the handicapped worker and his control counterpart(s). The second possibility is minimized because the supervisor evaluated each worker in comparison with his work group (i.e., with the other workers being evaluated). Thus, it may be concluded that the significant item differences observed between handicapped and control groups represented actual differences be-

tween the groups. (These items were: over-all ranking and quality of work performed.)

A similar conclusion may not be drawn for the skilled vs. nonskilled, and blue-collar vs. white-collar comparisons. In these comparisons, only the second possibility can be eliminated (i.e., that the difference is due to differing standards used by the same supervisor). This is so because the same supervisor did **not** evaluate both types of workers (and therefore could not have utilized differing standards.) Thus, significant item differences observed between skilled and nonskilled groups, and between blue-collar and white-collar groups, may be due to actual differences between the groups and/or due to the fact that different supervisors evaluated each group. The most that can be said is that (a) on job suitability, skilled workers were evaluated by **their** supervisors more favorably than the nonskilled workers were by **their** supervisors; (b) on absences and lateness, the nonskilled workers were evaluated more favorably by their supervisors (than were the skilled workers); and (c) on disciplinary actions, quality of work, promotability, and recommendation for pay raise, the white-collar workers were evaluated more favorably by their supervisors than were the blue-collar workers.

Development of the Scales

The conclusions developed from item analysis must be regarded as tentative. Scores obtained from single items lack the stability required for research or administrative purposes. It was necessary, as the next step, to combine items into scales in such a manner as to increase the stability of (scale) scores, while at the same time maintaining their meaning as indices of "satisfactoriness." That is, the objective was to combine the items into scales which produced stable and unambiguous "satisfactoriness" scores. Factor analysis was used to attain this objective.

Each of the item intercorrelation matrices presented in Appendix D, one for each group studied, was factor analyzed using the principal components method. Kaiser's criterion was used to determine the number of factors to be extracted from each matrix. The squared multiple correlation coefficient obtained between each item and all other items was utilized as the first approximation of original communality. In an attempt to approximate simple structure as nearly as possible the principal factors were rotated orthogonally using Kaiser's varimax solution. All computations were

undertaken on a Control Data 1604 computer, using the program written by Lawrence Liddiard.[6]

Tables 3 through 10 show the factor pattern of the "satisfactoriness" items for each group. These tables present the factor loadings and the estimated communalities for each item. A factor loading may be interpreted as the correlation between the item and the

Table 3. Varimax multiple factor matrix of original ten items for Group I: Handicapped, nonskilled blue-collar (N = 163)

Item	Factors I	Factors II	Communality	SMC*
Absence	.337	.605	.479	.481
Lateness	.165	.728	.557	.481
Accidents	.346	.573	.448	.411
Disciplinary action	.456	.251	.271	.287
Job suitability	.012	.365	.133	.137
Quality of work	.581	.485	.573	.556
Promotability	.700	.015	.480	.420
Pay raise	.698	.117	.502	.462
Heron adjustment criterion	.656	.267	.502	.454
Alternation ranking	.580	.286	.418	.391
Contribution of factor	2.551	1.823	4.374	
Proportion of common variance	.58	.42	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

factor, while communality indicates the proportion of the item's variance that is in "common" with the variance of the other items. Thus, factor loadings are used to identify the factor (because the items identify the major determinants of the factor), while communalities may be used to evaluate the items' relative independence (i.e., how much or how little they have in common with the other items).

The most significant finding resulting from the eight factor analyses is the uniformity of the factor structure of "satisfactoriness" which appears among the groups. For six of the eight groups the same two factors appeared, while for the two remaining groups the same three factors appeared.

Table 3 shows that "satisfactoriness" for Group I (handicapped, nonskilled, blue-collar) may be represented by two factors. The first and dominant factor (in terms of proportion of common vari-

[6] At the Numerical Analysis Center, University of Minnesota.

ance) has high loadings on, and is thus defined by, the disciplinary action, quality of work performed, promotability, pay raise, Heron adjustment criterion and alternation ranking items. Because of its high loadings on the promotability, pay raise items, quality of work, and alternation ranking items, this factor has been named the "performance" factor. It should be noted, however, that "performance" for Group I includes loadings on two "adjustment" items: disciplinary action and the Heron adjustment criterion.

Factor II for Group I has high loadings on the lateness, absence, and accident items. The quality of work and job suitability items also load to some extent on Factor II. Because absence, tardiness and accidents reflect violations of rules which are necessary to any organization, Factor II represents a "conformance-to-rules" dimension. (These items represent what are commonly described as "withdrawal symptoms" which are most noticeable in the organized work situation.)

"Satisfactoriness" for Group II (control, nonskilled blue-collar) has a factor structure similar to its handicapped counterpart. Again, the dominant factor is "performance" which, for Group II, accounts for an even larger portion of the common variance than it does for Group I. Factor II for Group II is similarly defined by the absence, lateness and accident items and is thus the conformance factor. Table 4 shows these findings.

Table 4. Varimax multiple factor matrix of original ten items for Group II: Control, nonskilled blue-collar (N = 185)

Item	Factors I	Factors II	Communality	SMC*
Absence	.232	.781	.633	.571
Lateness	.165	.772	.623	.549
Accidents	.266	.484	.306	.285
Disciplinary action	.594	.337	.467	.457
Job suitability	.010	.271	.074	.076
Quality of work	.716	.337	.626	.572
Promotability	.838	.030	.703	.632
Pay raise	.730	.051	.536	.543
Heron adjustment criterion	.605	.307	.460	.446
Alternation ranking	.603	.148	.385	.398
Contribution of factor	2.982	1.830	4.812	
Proportion of common variance	.62	.38	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

These findings indicate that the supervisors who evaluated non-skilled blue-collar workers, both handicapped and control, perceived "satisfactoriness" as represented by two components, "performance" and "conformance to rules."

Table 5 indicates that the same two factors appeared in "satisfactoriness" for Group III (handicapped, skilled blue-collar) as for Groups I and II. However, the factor analysis for this group indicated the possibility of a third factor. This possibility is discussed in a later section.

Table 5. Varimax multiple factor matrix of original ten items for Group III: Handicapped, skilled blue-collar (N = 90)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.168	.734	.567	.528
Lateness	.256	.805	.714	.623
Accidents	.208	.506	.299	.282
Disciplinary action	.509	.139	.278	.301
Job suitability	.378	.209	.186	.234
Quality of work	.570	.320	.428	.400
Promotability	.686	.119	.484	.444
Pay raise	.656	.169	.459	.422
Heron adjustment criterion	.634	.254	.466	.431
Alternation ranking	.439	.157	.218	.261
Contribution of factor	2.359	1.741	4.100	
Proportion of common variance	.58	.42	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

Factor I for Group III is the performance factor discussed earlier, with one notable modification: the job suitability item loads heaviest on the performance factor rather than the conformance factor. It appears that for the handicapped, skilled blue-collar workers, adjustment (as represented by the disciplinary action, job suitability, and Heron adjustment criterion items) is seen by supervisors as related to "performance."

Factor II for Group III has loadings only on the absence, lateness and accident items and is thus the conformance-to-rules factor.

Table 6 shows that three factors appeared in "satisfactoriness" for Group IV. The third factor, however, appears to be a further subdivision of Factor I as found in Groups I, II and III. Factor I has its highest loadings on the promotability, pay raise, quality of work, and alternation ranking items, and is thus the performance

Table 6. Varimax multiple factor matrix of original ten items for Group IV: Control, skilled blue-collar (N = 111)

Item	Factors I	II	III	Communality	SMC*
Absence	.169	.735	—.249	.631	.564
Lateness	.196	.765	—.142	.643	.567
Accidents	.208	.720	—.188	.597	.546
Disciplinary action	.468	.192	—.585	.599	.540
Job suitability	.033	.170	—.577	.341	.279
Quality of work	.586	.382	—.213	.535	.507
Promotability	.821	.176	—.236	.760	.706
Pay raise	.801	.155	.020	.667	.614
Heron adjustment criterion	.464	.331	—.562	.641	.589
Alternation ranking	.569	.150	—.316	.446	.442
Contribution of factor	2.529	2.042	1.289	5.860	
Proportion of common variance	.43	.35	.22	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

factor. Factor I has secondary loadings on the disciplinary action and Heron adjustment criterion items. These items, together with the job suitability item constitute Factor III, the "adjustment" factor. Factor II, the conformance factor, is again defined by the absence, lateness and accident items.

It appears, therefore, that for the skilled blue-collar workers the adjustment factor (defined by the disciplinary action, job suitability and Heron adjustment criterion items) seems to be distinct from "performance." In contrast, for the unskilled blue-collar groups, these "adjustment" items combine with the "performance" items to form an over-all performance factor. The conformance-to-rules factor, however, appears very similar for all blue-collar groups.

Table 7 shows that for Group V (handicapped, non-skilled white-collar) two factors define "satisfactoriness." Factor I is the same performance factor and Factor II the same conformance-to-rules factor observed for the nonskilled blue-collar workers.

"Satisfactoriness" for Group VI (control, nonskilled white-collar), as shown in Table 8 has a factor structure similar to its handicapped counterpart. Factor I is again the performance factor while Factor II is the conformance factor.

One may conclude, therefore, that the factor structure of "satisfactoriness" for nonskilled blue- and white-collar workers is very similar. In all four groups (handicapped and control, non-skilled, blue- and white-collar) the dominant factor is "performance" while

Table 7. Varimax multiple factor matrix of original ten items for Group V: Handicapped, nonskilled white-collar (N = 128)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.246	.685	.529	.476
Lateness	.319	.736	.643	.555
Accidents	.061	.620	.388	.318
Disciplinary action	.479	.336	.343	.372
Job suitability	.314	.107	.110	.148
Quality of work	.795	.183	.666	.605
Promotability	.731	.200	.574	.565
Pay raise	.617	.181	.413	.424
Heron adjustment criterion	.578	.319	.436	.449
Alternation ranking	.524	.064	.279	.285
Contribution of factor	2.649	1.731	4.381	
Proportion of common variance	.60	.40	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

Table 8. Varimax multiple factor matrix of original ten items for Group VI: Control, nonskilled white-collar (N = 112)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.128	.708	.518	.441
Lateness	.244	.744	.613	.530
Accidents	.084	.659	.441	.389
Disciplinary action	.501	.352	.375	.423
Job suitability	.381	.154	.169	.189
Quality of work	.798	.183	.668	.622
Promotability	.733	.081	.544	.510
Pay raise	.648	.214	.466	.462
Heron adjustment criterion	.739	.199	.585	.563
Alternation ranking	.700	.018	.491	.448
Contribution of factor	3.106	1.762	4.868	
Proportion of common variance	.64	.36	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

the secondary factor is "conformance-to-rules." These factors are defined by the same sets of items for all four groups.

Table 9 shows that two factors appeared in "satisfactoriness" for Group VII (handicapped, skilled white-collar workers). Factor I is the same performance factor and Factor II the same conformance-to-rules factor observed in earlier groups. As it did for Group III, the factor analysis for Group VII indicated the possibility of a third factor. This, too, is discussed later.

Table 9. Varimax multiple factor matrix of original ten items for Group VII: Handicapped, skilled white-collar (N = 108)

Item	Factors I	Factors II	Communality	SMC*
Absence	.299	.727	.618	.583
Lateness	.259	.781	.677	.600
Accidents	.262	.638	.473	.436
Disciplinary action	.602	.285	.444	.445
Job suitability	.411	.322	.272	.288
Quality of work	.519	.427	.452	.479
Promotability	.817	.206	.710	.668
Pay raise	.649	.270	.494	.551
Heron adjustment criterion	.735	.266	.611	.566
Alternation ranking	.478	.361	.358	.345
Contribution of factor	2.883	2.227	5.111	
Proportion of common variance	.56	.44	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

The factor structure of "satisfactoriness" for Group VIII (control, skilled white-collar) consists of three factors (see Table 10). Factor I is defined by loadings on the promotability, pay raise, Heron adjustment criterion, and quality of work items, along with the alternation ranking, disciplinary action and job suitability items, also load on Factor III. Factor I is thus the performance factor and Factor III the adjustment factor similar to those found for Group IV (control,

Table 10. Varimax multiple factor matrix of original ten items for Group VIII: Control, skilled white-collar (N = 88)

Item	Factors I	Factors II	Factors III	Communality	SMC*
Absence	.084	.748	−.015	.566	.510
Lateness	−.030	.786	.090	.627	.560
Accidents	.147	.562	.170	.367	.387
Disciplinary action	.379	−.025	.510	.405	.383
Job suitability	.068	.079	.592	.363	.314
Quality of work	.407	.461	.483	.611	.556
Promotability	.770	.120	.331	.717	.663
Pay raise	.748	.090	.151	.588	.537
Heron adjustment criterion	.562	.099	.587	.670	.607
Alternation ranking	.270	.171	.586	.445	.411
Contribution of factors	1.882	1.773	1.702	5.358	
Proportion of common variance	.35	.33	.32	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

skilled blue-collar). Factor II is the conformance factor, observed in all previous groups.

It appears, therefore, that a difference in the factor structure of "satisfactoriness" exists between skilled and nonskilled workers, at least for the control groups. Two factors (performance, conformance-to-rules) appear for nonskilled workers, both blue- and white-collar, while three factors (performance, conformance, adjustment) appear for the skilled workers. In addition, it should be noted that the job suitability and disciplinary items contribute very little to the common variance of "satisfactoriness" in the nonskilled groups.

Refinement of the Scales

The factor analysis presented in the preceding section was intended to serve as a guide in the construction of scales or measures of "satisfactoriness."

The irregular patterns of loadings for the job suitability and disciplinary items, and the possibility that a third factor could be extracted for two groups (Groups IV and VIII) indicated the desirability of further factor analyses before decisions could be made in the selection of items to constitute the scales.

For all nonskilled groups (Groups I, II, V, VI) the disciplinary action and job suitability items were eliminated and the item intercorrelation matrices of the remaining eight items for the four groups were factor analyzed.

Three factors were extracted for the handicapped skilled workers, both blue- and white-collar (Groups III and VII) in order to make similar the factor structures for the handicapped and control skilled worker groups.

The results will be presented by nonskilled and skilled groups.

Nonskilled Groups.—Tables 11 through 14 present the factor analyses of the selected set of eight items for Groups I, II, V and VI. Examination of the tables shows that remarkably uniform results appeared for all four groups.

Table 11 shows that two factors appeared for Group I (handicapped, nonskilled blue-collar). The first factor has high factor loadings on the pay raise, promotability, Heron adjustment criterion, quality of work, and alternation ranking items. This is the performance factor identified in the earlier analysis. Factor II has high loadings on the absence, lateness and accident items and is the conformance-to-rules factor. The pattern of loadings is clear

Table 11. Varimax multiple factor matrix of selected eight items for Group I: Handicapped, nonskilled blue-collar (N = 163)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.277	.664	.518	.479
Lateness	.110	.734	.550	.466
Accidents	.281	.606	.446	.400
Quality of work	.565	.502	.571	.546
Promotability	.673	.104	.464	.401
Pay raise	.699	.187	.524	.458
Heron adjustment criterion	.608	.308	.465	.409
Alternation ranking	.556	.319	.411	.377
Contribution of factor	2.108	1.841	3.948	
Proportion of common variance	.53	.47	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

for all items except the quality of work item. This item loads almost as heavily on the conformance factor as it does on the performance factor.

The factor structure for Group II (Table 12) is essentially the same as for Group I, with a somewhat clearer pattern of loadings. The two factors for Group II are again the performance and conformance factors defined by the same set of items noted previously. Similar results were obtained for Groups V and VI (see Tables 13 and 14).

Table 12. Varimax multiple factor matrix of selected eight items for Group II: Control, nonskilled blue-collar (N = 185)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.185	.789	.657	.571
Lateness	.113	.773	.610	.535
Accidents	.233	.501	.306	.284
Quality of work	.680	.375	.603	.538
Promotability	.832	.096	.701	.620
Pay raise	.740	.104	.558	.542
Heron adjustment criterion	.558	.339	.426	.400
Alternation ranking	.591	.201	.390	.397
Contribution of factor	2.464	1.788	4.252	
Proportion of common variance	.58	.42	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

Table 13. Varimax multiple factor matrix of selected eight items for Group V: Handicapped, nonskilled white-collar (N = 128)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.249	.693	.543	.475
Lateness	.320	.738	.647	.554
Accidents	.057	.617	.383	.312
Quality of work	.790	.188	.660	.591
Promotability	.747	.205	.600	.549
Pay raise	.606	.193	.405	.397
Heron adjustment criterion	.527	.302	.369	.358
Alternation ranking	.536	.076	.293	.280
Contribution of factor	2.282	1.617	3.899	
Proportion of common variance	.59	.41	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

Table 14. Varimax multiple factor matrix of selected eight items for Group VI: Control, nonskilled white-collar (N = 112)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.110	.691	.489	.408
Lateness	.233	.752	.619	.527
Accidents	.087	.668	.454	.387
Quality of work	.790	.201	.664	.602
Promotability	.731	.089	.543	.487
Pay raise	.664	.238	.498	.457
Heron adjustment criterion	.701	.193	.528	.475
Alternation ranking	.707	.034	.501	.445
Contribution of factor	2.665	1.631	4.297	
Proportion of common variance	.62	.38	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

The elimination of the disciplinary action and job suitability items, therefore, had a simplifying effect on factor structure. It was now possible to assign the remaining eight items to one of the two scales without discarding a disproportionate amount of the common variance for that factor. This meant that two relatively independent scales could be constructed for all groups of nonskilled workers. The **performance scale** was constructed from the alternation ranking, quality of work, promotability, pay raise and Heron adjustment criterion items. Scores for this scale were obtained by summating the corresponding scores for the five items. Performance scores

ranged from 5 to 23, with higher scores indicating a more satisfactory supervisory evaluation of the individual's work performance. The **conformance scale** consisted of the absence, lateness and accident items. Scale scores were obtained in a manner similar to performance scores. Scores for the conformance scale ranged from 3 to 15, with higher scores again representing a more satisfactory supervisory evaluation of the individual's conformance to organizational rules.

Handicapped skilled groups.—The original factor analysis for Groups III and VII indicated that a third factor might profitably be extracted from the correlation matrix. Tables 15 and 16 present the results of "forcing" a third factor for Groups III and VII.

In general, these results appear similar to those for the control group counterparts of Groups III and VII. However, forcing a third factor equalized the proportion of common variance among the factors. The first factor for Group III (handicapped, skilled blue-collar) has high loadings in the alternation ranking, quality of work, promotability and pay raise items. Factor I is thus the original performance factor. Factor II is the conformance-to-rules factor, with loadings in the absence, lateness and accident items. Factor III is the difficult factor to interpret. It has high loadings in the adjustment items of disciplinary action, job suitability and the

Table 15. Varimax multiple factor matrix of original ten items forcing three factors for Group III: Handicapped, skilled blue-collar (N = 90)

Item	Factors I	II	III	Communality
Absence	.094	.727	.177	.569
Lateness	.207	.797	.190	.715
Accidents	.183	.500	.132	.301
Disciplinary action	.156	.116	.579	.373
Job suitability	.197	.195	.350	.199
Quality of work	.509	.306	.307	.447
Promotability	.563	.100	.408	.494
Pay raise	.540	.151	.392	.468
Heron adjustment criterion	.304	.229	.609	.516
Alternation ranking	.519	.150	.099	.302
Contribution of factors	1.378	1.668	1.337	4.383
Proportion of common variance	.31	.38	.31	1.00

Note: The estimated communalities (squared multiple correlation coefficients) are the same as in Table 5.

Table 16. Varimax multiple factor matrix of original ten items forcing three factors for Group VII: Handicapped, skilled white-collar (N = 108)

Item	Factors			Communality
	I	II	III	
Absence	.256	.716	—.233	.632
Lateness	.185	.758	—.265	.680
Accidents	.177	.610	—.264	.474
Disciplinary action	.425	.230	—.462	.448
Job suitability	.158	.241	—.499	.332
Quality of work	.277	.350	—.533	.483
Promotability	.719	.177	—.426	.729
Pay raise	.696	.288	—.188	.603
Heron adjustment criterion	.510	.195	—.568	.620
Alternation ranking	.247	.287	—.497	.391
Contribution of factors	1.735	1.927	1.728	5.390
Proportion of common variance	.32	.36	.32	1.00

Note: The estimated communalities (squared multiple correlation coefficients) are the same as in Table 9.

Heron adjustment criterion. In addition, it has significant loadings in the quality of work, promotability and pay raise items.

Table 16 presents the findings for Group VII (handicapped, skilled white-collar). Factor I has high loadings in the disciplinary action, promotability, pay raise and Heron adjustment criterion items. Factor I thus represents some combination of adjustment and performance. Its highest loadings, however, are in the "reward for performance" items (promotability, pay raise), thus indicating it is more of a performance factor.

Factor II is again the well-defined conformance-to-rules factor, identified by high loadings in the absence, lateness and accident items. (This factor consistently emerged in all factorial refinements.)

Factor III for Group V has high loadings in the alternation ranking, disciplinary action, job suitability, quality of work, promotability, and Heron adjustment criterion items. Factor III, like Factor I, is thus a combination of adjustment and performance items. However, for Factor III the "adjustment" items predominate. Factor III is therefore more the adjustment factor, while Factor I is the performance factor.

Three factors are thus present in the supervisor's evaluation of the skilled workers. One factor, consisting usually of the alternation ranking, quality of work, promotability and pay raise items, is the performance factor. A second factor is the same conformance-

to-rules factor observed for every group. The third factor usually has high loadings in the disciplinary action, job suitability and Heron adjustment criterion items. This is an adjustment factor.

The factors for the skilled workers, however, are not nearly as well defined as they are for the nonskilled workers. It would be very difficult to construct a uniform set of three scales for all skilled groups. The difficulty would arise mainly in determining the scale membership of the disciplinary action and job suitability items. Furthermore, grouping the items into the three scales would result in discarding a significant amount of the common variance for each factor. Thus, the scales would lose much of their meaning and independence.

One alternative would be to eliminate the difficulty-producing disciplinary action and job suitability items. This procedure might simplify the factor structure by eliminating much of the overlap between the performance and adjustment factors. If the remaining eight items were then factor analyzed for each of the four skilled groups, the adjustment factor might be expected to disappear. This is in fact what happened.

Tables 17 through 20 present the results of the factor analysis using the eight selected items for the skilled groups (Groups III, IV, VII, VIII). The same two factors appeared in all four groups. Moreover, these two factors are the same as those discovered for the nonskilled workers. Factor I has high loadings in the alternation ranking, quality of work, promotability, pay raise and Heron ad-

Table 17. Varimax multiple factor matrix of selected eight items for Group III: Handicapped, skilled blue-collar (N = 90)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.164	.738	.571	.509
Lateness	.250	.789	.685	.584
Accidents	.211	.510	.304	.274
Quality of work	.557	.324	.416	.371
Promotability	.714	.125	.525	.444
Pay raise	.669	.178	.480	.411
Heron adjustment criterion	.550	.282	.382	.335
Alternation ranking	.475	.148	.247	.257
Contribution of factor	1.930	1.680	3.610	
Proportion of common variance	.53	.47	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

Table 18. Varimax multiple factor matrix of selected eight items for Group IV: Control, skilled blue-collar (N = 111)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.198	.770	.632	.557
Lateness	.200	.770	.633	.566
Accidents	.243	.727	.588	.527
Quality of work	.612	.406	.540	.504
Promotability	.854	.198	.769	.702
Pay raise	.751	.127	.580	.585
Heron adjustment criterion	.554	.436	.497	.489
Alternation ranking	.631	.204	.439	.436
Contribution of factor	2.511	2.166	4.677	
Proportion of common variance	.54	.46	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

justment criterion items. This is the same performance factor noted earlier for the nonskilled groups. Factor II is the conformance-to-rules factor, with loadings in the absence, lateness and accidents items. This factor also appeared for the nonskilled groups.

In conclusion, the factor structure of "satisfactoriness" for the skilled groups was clarified by the elimination of the two adjustment items. This procedure reduced the common variance in the correlation matrix to the extent that only two factors were necessary to account for it. A secondary effect was to localize most of

Table 19. Varimax multiple factor matrix of selected eight items for Group VII: Handicapped, skilled white-collar (N = 108)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.292	.728	.616	.578
Lateness	.253	.783	.678	.597
Accidents	.271	.638	.481	.433
Quality of work	.532	.417	.457	.453
Promotability	.840	.210	.749	.664
Pay raise	.673	.272	.527	.549
Heron adjustment criterion	.674	.287	.536	.491
Alternation ranking	.443	.363	.328	.307
Contribution of factor	2.313	2.058	4.371	
Proportion of common variance	.53	.47	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

Table 20. Varimax multiple factor matrix of selected eight items for Group VIII: Control, skilled white-collar (N = 88)

Item	Factors I	Factors II	Communality	SMC[a]
Absence	.083	.727	.536	.488
Lateness	.032	.788	.621	.540
Accidents	.239	.557	.368	.366
Quality of work	.608	.466	.587	.530
Promotability	.830	.086	.696	.648
Pay raise	.717	.037	.516	.535
Heron adjustment criterion	.759	.116	.589	.530
Alternation ranking	.550	.191	.339	.350
Contribution of factor	2.514	1.736	4.250	
Proportion of common variance	.59	.41	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

the common variance for the Heron adjustment criterion item in the performance factor.

As a result of the above analysis, a uniform set of scales representing "satisfactoriness" was constructed for all eight groups. The **performance scale** consisted of five items: alternation ranking,

Table 21. Hoyt reliability coefficients for the satisfactoriness scales, by group

Group	Scales: Performance (5 items)	Scales: Conformance (3 items)
I. Handicapped, nonskilled blue-collar	.82	.77
II. Control, nonskilled blue-collar	.83	.77
III. Handicapped, skilled blue-collar	.77	.77
IV. Control, skilled blue-collar	.84	.85
V. Handicapped, nonskilled white-collar	.80	.78
VI. Control, nonskilled white-collar	.85	.78
VII. Handicapped, skilled white-collar	.83	.82
VIII. Control, skilled white-collar	.83	.76

quality of work, promotability, pay raise and Heron adjustment criterion. The **conformance-to-rules scale** consisted of three items: absences, lateness and accidents.

Table 21 presents the reliability coefficients for the performance and conformance scales. These coefficients were computed using the Hoyt analysis of variance method.[7] The coefficients range from

[7] Hoyt, C. J. Test reliability estimated by analysis of variance. *Psychometrika*, 1941, 3, 153-160.

.76 to .85, most of them being in the low .80's. The performance scale is more reliable, with a median coefficient of .83. Thus, one may conclude that the "satisfactoriness" scales developed through factor analysis as described in the preceding section are sufficiently homogeneous to be considered as scales.

Table 22 shows the inter-scale correlation for each of the eight groups. The median inter-scale correlation coefficient is .44. For all groups, the common variance between the performance and conformance scales is less than 35 percent. These data indicate that the scales are sufficiently independent to justify separate use.

Table 22. Correlation between performance scale and conformance scale, by group

Group	Correlation
I. Handicapped, nonskilled blue-collar	.50
II. Control, nonskilled blue-collar	.41
III. Handicapped, skilled blue-collar	.44
IV. Control, skilled blue-collar	.49
V. Handicapped, nonskilled white-collar	.44
VI. Control, nonskilled white-collar	.32
VII. Handicapped, skilled white-collar	.58
VIII. Control, skilled white-collar	.29

Analysis of scale variance

Having developed two measures of satisfactoriness, it now became possible to compare handicapped and control, skilled and non-skilled, and blue- and white-collar groups on the basis of more stable, more meaningful scores. The analysis of variance technique described in the section on Item Analysis, was again utilized for these comparisons. As described above, scale scores were obtained

Table 23. Distribution of scale means, by groups

Group	Scales	
	Performance	Conformance
I. Handicapped, nonskilled blue-collar	14.36	10.79
II. Control, nonskilled blue-collar	14.41	10.88
III. Handicapped, skilled blue-collar	15.11	10.31
IV. Control, skilled blue-collar	15.10	10.45
V. Handicapped, nonskilled white-collar	15.42	10.78
VI. Control, nonskilled white-collar	16.50	10.70
VII. Handicapped, skilled white-collar	16.31	10.35
VIII. Control, skilled white-collar	16.30	10.23

by summating the item scores for each scale. This resulted in two "satisfactoriness" scores for each individual. Table 23 presents the mean scale scores for each scale and for each group.

The hypotheses tested were similar to those tested in the Item Analysis Section. That is, given one aspect of "satisfactoriness" (performance or conformance), is there a statistically significant difference in mean scale score between (a) handicapped and control groups; (b) skilled and nonskilled; and (c) blue- and white-collar groups? The relevant data are shown in Table 23 and Appendix E. The following were the findings:

(a) On both the performance and conformance scales, the handicapped workers were evaluated as being equal to the control workers.

(b) The skilled workers received higher mean ratings than the nonskilled workers on both the performance and conformance scales.

(c) The white-collar workers received a higher mean rating than the blue-collar workers on the performance scale.

Job Adjustment

Job adjustment, it may be recalled, has been defined conceptually as including satisfaction and satisfactoriness. That is, an individual's job adjustment at any point in time is defined by his satisfaction and satisfactoriness at that particular point. An important requirement is that satisfaction and satisfactoriness data be obtained at the same time. This requirement was taken into account in the development of data collection procedures for the Work Adjustment Project. It now remains only to combine the measures of satisfaction and satisfactoriness into an index of job adjustment. Since there are from five to eight measures of satisfaction to combine with two measures of satisfactoriness, the problem is again that of a parsimonious reduction of several measures into one or a few which adequately represent the original measures—the problem for which factor analysis was developed.

The following section presents the results of factor analyzing the satisfaction and satisfactoriness scales for each of the eight worker groups in the study. The correlation matrices which were factor analyzed are shown in Appendix F. Inspection of these correlation matrices shows that the satisfactoriness scales, while being moderately related to each other, are relatively independent of the satisfaction scales. This leads one to expect at least two factors in job adjustment.

Tables 24 through 31 present the factor structure of job adjustment for each of the eight groups. The factor structures are very similar and, as expected, consist of two factors for all but two groups. For these two groups (III and IV, handicapped and control, skilled blue-collar) three factors define job adjustment.

The major finding seems to be that the satisfaction and satisfactoriness components of job adjustment are not correlated. This finding is all the more striking since it was uniformly obtained for all eight groups under study. Thus, the initial conceptual distinction between satisfaction and satisfactoriness seems to have an operational basis. There is no necessary relationship between how well a person likes his work and how well he does at his work—not when the satisfaction and satisfactoriness scales developed in this study are used as the measures of job adjustment. With this prefatory conclusion, the factor structure of job adjustment for each worker group will be discussed.

Group I (handicapped, nonskilled blue-collar)—Table 24 presents the factor structure of job adjustment for Group I. Two factors explain the common variance for job adjustment. Factor I has highest loadings in the general job satisfaction, working conditions, supervision and compensation scales, with smaller loadings in the sensitivity and co-workers scales. Factor I is thus the satisfaction factor. Factor II has high loadings only in the satisfactoriness scales of performance and conformance. Factor II is thus the satisfactoriness factor. As one would expect with six measures of satisfaction and only two of satisfactoriness, the majority of the common variance is allocated to Factor I (72%).

Table 24. Varimax multiple factor matrix of satisfaction and satisfactoriness scales for Group I: Handicapped, nonskilled, white-collar (N = 163)

Scale	Factors I	Factors II	Communality	SMC*
Performance	.114	.628	.407	.287
Conformance	.039	.600	.362	.261
Working conditions	.716	—.044	.515	.441
Supervision	.714	.154	.534	.468
Compensation	.560	—.020	.314	.275
Co-workers	.331	.145	.131	.153
Sensitivity	.342	.119	.131	.111
General job satisfaction	.723	.111	.535	.447
Contribution of factor	2.100	.828	2.928	
Proportion of common variance	.72	.28	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

The complete factorial independence of satisfaction and satisfactoriness as measures of job adjustment can be observed from the factor matrix. The factor loadings of the satisfactoriness scales on the satisfaction factor are all near zero, as are the loadings of the satisfaction scales on the satisfactoriness factor. This means that the factors are nearly independent and that simple structure has been achieved in the rotation of the factors (see Technical Appendix). Substantively, it means that the handicapped nonskilled blue-collar workers who expressed most satisfaction with their employment were not necessarily the best workers as evaluated by their supervisors and vice versa.

Group II (control, nonskilled blue-collar)—The factor structure of job adjustment for Group II is presented in Table 25. Factor I accounts for the overwhelming proportion of the common variance

and is again the satisfaction factor. The highest loadings are in the general job satisfaction, compensation and co-workers scales with almost as high loadings in the working conditions, supervision and sensitivity scales. The satisfaction factor of job adjustment for the control, nonskilled blue-collar group appears therefore to differ slightly from the corresponding factor for its handicapped counterpart.

Factor II has high loadings in the performance and conformance scales, with near zero loadings in the satisfaction scales, and is thus the satisfactoriness component of job adjustment for Group II. The near zero loadings of the satisfaction scales on the satisfactoriness factor and of the satisfactoriness scales on the satisfaction factor again indicates the almost complete independence of these complementary aspects of job adjustment.

Table 25. Varimax multiple factor matrix of satisfaction and satisfactoriness scales for Group II: Control, nonskilled blue-collar (N = 184)

Scale	Factors I	Factors II	Communality	SMC*
Performance	−.092	.574	.338	.224
Conformance	.114	.561	.327	.216
Working conditions	.699	.040	.490	.454
Supervision	.649	−.032	.423	.395
Compensation	.722	.002	.521	.508
Co-workers	.719	−.027	.517	.485
Sensitivity	.569	.021	.324	.349
General job satisfaction	.763	.079	.589	.546
Contribution of factor	2.876	.653	3.529	
Proportion of common variance	.81	.19	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

Group III (handicapped, skilled blue-collar)—Table 26 presents the factor structure of job adjustment for Group III. Three factors are required to explain the common variance in job adjustment for Group III. Factor I, which accounts for 42% of the common variance, has high loadings in the working conditions, co-workers, company, and type of work scales. It is thus a satisfaction factor. Factor II has high loadings in the general job satisfaction, supervision, compensation, company and sensitivity scales. Factor II, which accounts for 39% of the common variance, is also a satisfaction factor. Factor III, with high loadings in the performance and conformance scales and insignificant loadings in the satisfaction scales, is the satisfac-

Table 26. Varimax multiple factor matrix of satisfaction and satisfactoriness scales for Group III: Handicapped, skilled, blue-collar (N = 88)

Scale	Factors I	II	III	Communality	SMC[a]
Performance	.006	—.157	.652	.449	.348
Conformance	.033	.024	.568	.324	.239
Working conditions	.722	—.208	.005	.564	.575
Supervision	.213	—.688	.255	.584	.518
Compensation	.028	—.629	—.141	.416	.353
Co-workers	.716	.112	.095	.534	.471
Sensitivity	.439	—.401	.233	.408	.435
Company	.668	—.586	—.118	.803	.730
Type of work	.604	—.273	—.006	.440	.472
General job satisfaction	.190	—.697	.240	.580	.508
Contribution of factor	2.121	2.015	.967	5.103	
Proportion of common variance	.42	.39	.19	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

toriness factor. Factor III accounts for only 19% of the common variance in job adjustment for Group III.

Group IV (control, skilled blue-collar)—Table 27 presents the factor structure of job adjustment for Group IV. For this group, as for Group III, three factors are needed to explain the common variance in job adjustment. Factor I accounts for 61% of the common variance and has high loadings in the company, supervision, general job satisfaction, compensation and working conditions scales. It is therefore a satisfaction factor of job adjustment. Factor II, which accounts for 21% of the common variance, has high load-

Table 27. Varimax multiple factor matrix of satisfaction and satisfactoriness scales for Group IV: Control, skilled, blue-collar (N = 111)

Scale	Factors I	II	III	Communality	SMC[a]
Performance	.091	.619	.204	.433	.315
Conformance	.048	.578	.092	.344	.256
Working conditions	.548	.007	.235	.356	.363
Supervision	.699	—.063	.262	.562	.476
Compensation	.665	.021	.072	.448	.418
Co-workers	.343	.143	.505	.393	.304
Sensitivity	—.048	.187	.508	.295	.232
Company	.783	.162	—.096	.649	.556
General job satisfaction	.685	.237	—.066	.530	.491
Contribution of factor	2.445	.860	.705	4.010	
Proportion of common variance	.61	.21	.18	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

ings only in the performance and conformance scales and insignificant loadings in the satisfaction scales. It is the satisfactoriness component of job adjustment. Factor III accounts for 18% of the common variance and has high loadings only in the co-workers and sensitivity scales. It is a satisfaction factor in job adjustment.

The preceding factor-analytic findings for blue-collar workers may be summarized as follows:

1. Satisfaction and satisfactoriness are independent components of job adjustment.
2. Slight differences in the satisfaction components of job adjustment appear between handicapped and control groups.
3. Differences in the factor structure of job adjustment are greater between skill levels than between the handicapped and their control counterparts. The higher skill level has the more complex factor structure.

Group V (handicapped, nonskilled white-collar)—Table 28 presents the factor structure of job adjustment for Group V. Two factors appeared to account for the common variance in job adjustment for the handicapped, nonskilled white-collar workers. Factor I, the satisfaction factor, accounts for 73% of the common variance and has high loadings in the supervision, general job satisfaction, working conditions, compensation, and co-workers scales, with a smaller loading in the sensitivity scale. It is very similar to Factor I for Group I (handicapped, nonskilled, blue-collar).

Table 28. Varimax multiple factor matrix of satisfaction and satisfactoriness scales for Group V: Handicapped, nonskilled, white-collar (N = 123)

Scale	Factors I	Factors II	Communality	SMC*
Performance	.048	.567	.324	.235
Conformance	.103	.594	.364	.258
Working conditions	.572	—.217	.374	.381
Supervision	.835	.108	.709	.641
Compensation	.562	.046	.318	.322
Co-workers	.524	.236	.331	.439
Sensitivity	.310	.097	.106	.132
General job satisfaction	.727	.178	.560	.488
Contribution of factors	2.253	.833	3.086	
Proportion of common variance	.73	.27	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

Factor II, the satisfactoriness factor, has high loadings in the performance and conformance scales and insignificant loadings on the other scales. The factor structure of job adjustment for Group V is therefore very much like that for Group I, its blue-collar counterpart.

Group VI (control, nonskilled white-collar)—The factor structure of job adjustment for Group VI is presented in Table 29. A satisfaction and a satisfactoriness factor again account for the common variance in job adjustment. Factor I, the satisfaction factor, has high loadings in the working conditions, compensation, supervision and general job satisfaction scales, and accounts for 70% of the common variance. This factor is quite different from the corresponding factor for Group II, Group VI's blue-collar counterpart. Factor II, which accounts for the remaining 30% of the common variance, is the satisfactoriness factor with highest loadings in the performance and conformance scales. Two observations concerning the factor matrix for Group VI should be noted: (a) The common variance represented in the factors is the smallest proportion of total variance extracted for any of the eight groups; (b) The performance scale has a significant loading on the satisfaction factor. Furthermore, the co-workers scale loads significantly on the satisfactoriness factor.

Group VII (handicapped, skilled white-collar)—Table 30 presents the factor structure of job adjustment for handicapped, skilled white-collar workers. Factor I, which accounts for 58% of the com-

Table 29. Varimax multiple factor matrix of satisfaction and satisfactoriness scales for Group VI: Control nonskilled, white-collar (N = 117)

Scale	Factors I	Factors II	Communality	SMC[a]
Performance	.391	.436	.343	.232
Conformance	.009	.481	.231	.135
Working conditions	.565	.047	.321	.250
Supervision	.458	−.099	.220	.177
Compensation	.561	−.158	.339	.254
Co-workers	.087	−.317	.108	.058
Sensitivity	.389	.047	.153	.156
General job satisfaction	.431	.046	.188	.190
Contribution of factor	1.341	.564	1.904	
Proportion of common variance	.70	.30	1.00	

[a] Estimated communalities: Squared multiple correlation coefficients.

mon variance, is the satisfaction factor, while Factor II is the satisfactoriness factor. Factor II for Group VII accounts for the largest proportion of common variance of any satisfactoriness factor observed for any of the groups. The satisfactoriness factor for Group VII is also unique in that it has significant loadings in the general job satisfaction and compensation scales. The factor structure of job adjustment for Group VII is not at all like that of its blue-collar counterpart, Group III. (See pp. 33-34.)

Group VIII (control, skilled white-collar)—The factor structure of job adjustment for Group VIII is presented in Table 31. For Group VIII, as for most of the groups, two factors appear. The first factor, which accounts for 79% of the common variance, has high loadings in all the satisfaction scales. Factor II again has high loadings only in the performance and conformance scales. Again, the factor structure of job adjustment for Group VIII is unlike that of its blue-collar counterpart, Group VI.

In general, slight and specific differences between handicapped and control, and between skilled and nonskilled, are observed in the factor structure of job adjustment for the white-collar groups. However, marked differences in the factor structure of job adjustment are observed between the corresponding white-collar and blue-collar groups. These differences reflect primarily the differences in employment satisfaction that were observed between these groups. The most important conclusion from the factor analyses reported above still seems to be the general finding that satisfaction and satisfactoriness are independent dimensions of job adjustment.

Table 30. Varimax multiple factor matrix of satisfaction and satisfactoriness scales for Group VII: Handicapped, skilled white-collar (N = 95)

Scale	Factors I	Factors II	Communality	SMC*
Performance	.165	.713	.535	.437
Conformance	.065	.666	.448	.367
Working conditions	.457	.203	.250	.255
Supervision	.696	.131	.502	.458
Compensation	.500	.325	.355	.358
Co-workers	.470	—.156	.245	.200
General job satisfaction	.756	.359	.700	.609
Contribution of factors	1.767	1.269	3.036	
Proportion of common variance	.58	.42	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

Table 31. Varimax multiple factor matrix of satisfaction and satisfactoriness scales for Group VIII: Control, skilled white-collar (N = 96)

Scale	Factors I	Factors II	Communality	SMC*
Performance	.076	.495	.251	.155
Conformance	−.050	.437	.193	.132
Working conditions	.524	−.102	.285	.246
Supervision	.660	.243	.495	.436
Compensation	.769	−.062	.596	.537
Co-workers	.588	.242	.404	.377
General job satisfaction	.750	−.064	.566	.518
Contribution of factors	2.218	.572	2.790	
Proportion of common variance	.79	.21	1.00	

* Estimated communalities: Squared multiple correlation coefficients.

Relationship Between Satisfaction and Satisfactoriness

The finding that satisfaction and satisfactoriness are independent factorial dimensions of job adjustment is of such major significance to the definition of work adjustment that a further analysis of the relationship between measures of the two concepts was deemed necessary. Some estimate of the actual relationship between the two sets of measures was desirable. It should be noted that the satisfaction and satisfactoriness factors derived through factor analysis were independent by virtue of the method of analysis used. That is, the factor analysis method used in the preceding section was designed to yield independent factors, and therefore the independence of satisfaction and satisfactoriness was arbitrarily "forced." The intercorrelation tables in Appendix F present the correlation of each satisfaction measure with each satisfactoriness measure, but what was needed was some estimate of the correlation between the set of all satisfaction measures taken at once and the corresponding set of all satisfactoriness measures.

Such an estimate could be obtained through the use of Hotelling's method of canonical correlation (more precisely, canonical variate analysis).[8] This method determines the maximum correlation between two sets of variables. The variables in each set are linearly weighted in such a way that the principal component in

[8] Hotelling, Harold. Relations between two sets of variates. *Biometrika*, 1936, 28, 321-377.

the set is represented. It is these principal components of the two sets of variables which are correlated. The canonical correlation between two sets of variables may then be interpreted as indicating the amount of common variance shared by the principal component of one set with the principal component of the other set.

Canonical variate analysis also yields regression or canonical weights, one for each variable. These weights are not easy to interpret. Burt believes the weights for the variables in one set to be proportional to the saturations of these variables on the principal component of the other set.[9] The weight for each variable does not take account of the relationships between the other variables in the set and the principal component of the other set. That is, each weight reflects the relationship of the variable taken alone and the principal component of the other set. In this sense, canonical variate analysis is not at all like multiple regression analysis, but rather more like factor analysis.

The computer program for canonical correlation used in this study was written by Donald Hester and obtained from Yale University. This program was modified by Richard Heller of the Service Bureau Corporation, Minneapolis, and Darshan Sachdeva of the Work Adjustment Project staff. The analysis was performed on an IBM 650 machine.

Tables 32 and 33 present the findings for each of the eight groups under study. Table 32 presents the squared canonical correlation, while Table 33 lists the canonical weights.

It is apparent from Table 32 that at most there is only a slight relationship between the set of satisfaction variables and the set of satisfactoriness variables. The squared canonical correlations (proportion of common variance between principal components) are uniformly very low. The two highest correlations are observed for the handicapped, skilled, blue- and white-collar groups. The data in Table 32 suggest that the relationship between satisfaction and satisfactoriness is stronger for the skilled than for the nonskilled groups, and among the skilled workers it is stronger for the handicapped than for their control counterparts.

The canonical weights for the different variables (Table 33), are all given in a ratio to the weight of the performance scale, which is given the value of 1.00 for all groups. Performance is generally

[9] Burt, C. Factor analysis and canonical correlation. *Brit. J. Psy. Stat. Sec.*, 1948, 1, 95-160.

Table 32. Squared canonical correlation between satisfaction and satisfactoriness, by group

Group	Squared canonical correlation
I. Handicapped, nonskilled blue-collar	.068
II. Control, nonskilled blue-collar	.064
III. Handicapped, skilled blue-collar	.260
IV. Control, skilled blue-collar	.152
V. Handicapped, nonskilled white-collar	.074
VI. Control, nonskilled white-collar	.158
VII. Handicapped, skilled white-collar	.233
VIII. Control, skilled white-collar	.046

more related than conformance to satisfaction. General job satisfaction and satisfaction with supervision tend to have the highest relationship, while satisfaction with working conditions tends to have the least relationship, with satisfactoriness. When the weights are ranked within a group, the greatest disparity in the patterns of ranks is observed between the blue- and white-collar groups. That is, "collar" or working environment accounts for greater variation in the rank pattern of weights than does skill level or presence/absence of a disability. These conclusions, however, are highly tentative and therefore of lesser significance. The principal finding is that measures of satisfaction are operationally independent of measures of satisfactoriness. This finding is supported by both the factorial and canonical analysis results.

Table 33. Canonical weights for the satisfactoriness and satisfaction scales, by group

	Groups[a]							
	I	II	III	IV	V	VI	VII	VIII
Satisfactoriness scales								
Performance	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Conformance	.051	.907	.275	.230	2.363	—.140	.161	—.342
Satisfaction scales								
Working conditions	—.084	.022	.010	.083	—.619	.260	.047	.032
Supervision	.183	—.038	.332	—.188	.392	.071	—.059	.139
Compensation	—.094	—.266	—.169	—.114	.173	—.010	.090	.039
Co-workers	.064	—.056	.140	.144	.140	—.126	—.220	.097
Sensitivity	.124	—.018	.287	.269	—.060	.005		
General job satisfaction	.088	.096	.357	.257	.430	.192	.516	—.140
Company			—.523	.142				
Type of work			—.022					

[a] See Table 32.

Use of the Instruments

The following section details the standardized procedures that should be followed when using the measures of satisfactoriness.

Administration.

Two instruments are needed to measure satisfactoriness: an Alternation Ranking Form and a Supervisor Evaluation Form. These are shown in Appendix A. These instruments are completed by the immediate supervisor of the person being evaluated. No special instructions for the supervisor are necessary. The forms may be completed after a reading of the instructions printed on the instruments. The Alternation Ranking Form is completed for the **work group** to which the individual being evaluated belongs, i.e., he is to be ranked among his co-workers. The Supervisor Evaluation Form may be completed only for the person being evaluated. Supervisor Evaluation Forms for his co-workers do not have to be filled out.

The two forms can be completed in five minutes or less. However, no time limits should be imposed on the individual completing the forms.

Scoring.

One set of scoring keys suffices for all occupational groups (both handicapped and non-handicapped). For the Alternation Ranking Form, workers ranked in the upper fourth of the group are given a score of 3; workers ranked in the middle half of the group are given a score of 2; and workers ranked in the bottom fourth are given a score of 1. On the Supervisor Evaluation Form, the evaluative categories for each item are given scoring weights from 1 (for the least favorable category) to 5 (for the most favorable category). These weights are shown in Appendix G.

The "performance" score of a person is obtained by adding the scores on the Alternation Ranking Form and the following items of the Supervisor Evaluation Form: 1) quality of work, 2) promotability, 3) recommendation for pay raise, 4) Heron adjustment criterion.

The "conformance-to-rules" score for a person is obtained by adding his scores on the absence, lateness, and accident items of the Supervisor Evaluation Form.

Norms.

Appendix H presents the percentile distribution, means, and standard deviations of the scale scores for each of the eight groups studied.

Figure 1 illustrates a summary score sheet for a hypothetical handicapped worker. The percentile scores were derived from Appendix H.

Employment Satisfactoriness

Identification: 11052

Name Smith, James W.

Present Job Title machinist

(4-75)

Counselor R. Johnson

Agency St. Paul Office

Notes

Administered by S.D.E. Date 11/19/63

Scored by EAL Date 11/19/63

Checked by MZW Date 11/18/63

Norm Group:	H	Non-H
Non-skilled blue collar	☐	☐
Skilled blue-collar	☑	☐
Non-skilled white collar	☐	☐
Skilled white-collar	☐	☐
Professional	☐	☐

Performance:

Quality of Work	4	
Promotability	3	
Rec. for Pay Raise	4	
Heron Adjustment	3	15

Alternation Ranking

✓ Top 1/4 = 3
Middle 1/2 = 2
Bottom 1/4 = 1

3

Total Performance Score---------- 18

Performance Percentile Score---------- 80

Conformance:

Absence	3
Lateness	3
Accidents	3

Total Conformance Score---------- 9

Conformance Percentile Score---------- 55

FIGURE 1. Illustrative Summary Score Sheet.

APPENDIXES

TECHNICAL APPENDIX

Factor Analysis

Factor analysis is a method of reducing a large set of variables to a smaller set of variables (called factors) through an analysis of the linear correlations among the original variables. The set of factors which results from the analysis incorporates most of the information in the original variables, thus attaining a parsimonious, yet comprehensive summary of the original data.

The results of factor analysis are presented in tables called factor matrices or tables of factor loadings. Tables in the text are examples of such tables. These tables list the original variables in the left hand column and the factors in the top row or boxhead. The cell entries in the tables are the factor loadings, which represent the correlations between the variables and the factors. A factor loading, therefore, may be interpreted in terms of the proportion of the variance in a given variable which is accounted for, or in common with, a given factor. This proportion, as in the interpretation of any correlation, is given by the square of the factor loading. For example, a factor loading of .50 means that .25 or 25% of the variance in the variable is accounted for by the factor. The last column on the right of each table, labeled "communality," shows the total proportion of the variance in a given variable which is accounted for by all the factors. The communality is also the proportion of the variance in a variable which is "in common with" the variance of the other original variables.

The basic idea behind factor analysis is to be found in the mathematical model which states that the total variance in the measurement of a variable is the result of adding together the independent variances due to the different factors (components, effects) which underlie the variable. Three kinds of factors are usually distinguished: common factors or factors which underlie the given variable as well as most of the other variables, i.e., "common" to this and other variables; specific factors, which underlie only the given variable and no other; and the error component (which is not really a factor). This mathematical model is presented below in equation form:

$$V_t = V_a + V_b + \ldots + V_n + V_s + V_e \qquad (1)$$

where V_t = the total variance in a variable

V_a = the variance due to Factor A,

V_b = the variance due to Factor B, etc.

Factors A, B, . . ., N are the common factors

Factor S is the specific factor

E is the error component

Equation (1) states that the total variance in a variable is a simple summation of component variances in the common factors, the specific factor, and the error component. If each variance component is divided by the total variance, the result would show the proportion of the total variance contributed by each component. This result may be expressed in equation form as follows:

$$1.00 = a^2 + b^2 + \ldots + n^2 + s^2 + e^2 \qquad (2)$$

where a^2 is the proportion of the variance in the variable contributed by Factor A,

b^2 is the proportion of the variance contributed by Factor B, etc.

Since a^2 is the proportion of the variance in the variable contributed or accounted for by Factor A, it follows that a (the square root of a^2) should be the correlation between the variable and Factor A. That is to say, a, b, . . ., n are the factor loadings. Also, $a^2 + b^2 + \ldots + n^2$ add up to the total proportion of the variance which is accounted for by all the factors, i.e., the communality (symbolized as h^2).

In summary, factor analysis starts with the communality or common variance of a variable and apportions this among several factors. This is done for each

variable in the original set of variables. Determining the factors may be done in one of several ways, called factor analytic solutions. The factor analytic solution used in this bulletin is called the principal components method. This method begins by extracting the factor which accounts for the largest portion of common variance across all the original variables. The variance accounted for by this factor is then subtracted from the common variance. A second factor is then extracted which accounts for the largest portion of the remaining common variance. The variance accounted for by the second factor is subtracted again, and the process repeated until no significant amount of common variance remains.

Thus the principal idea behind factor analysis is the apportionment of the common variance. The mathematics by which this is accomplished is considerably more involved. The interested reader is referred to Harman's *Modern Factor Analysis* for a theoretical presentation.

Several problems involved in factor analysis are worth noting. The first is that of deciding on what factor analytic solution to use. There are theoretically an infinite number of equally accurate ways of factoring a given matrix of intercorrelations. Factor analysts are generally agreed that the "best" solution should meet two criteria: (1) mathematical rigor, and (2) meaningfulness in terms of the content area involved. But there is no general agreement on which solution "best" meets the criteria, thus resulting in several "schools" of factor analysis.

A second problem is that of estimating communality. The communality of a variable is known in precise terms only after a factor analysis of the correlation matrix. Yet, factor analysis itself begins with communality. This paradox is resolved through different methods of estimating the communality. This results in different preferences in method. The method used in this bulletin is that of using the squared multiple correlation (R^2) of all other variables on each variable.

A third problem has to do with determining the number of factors to extract. One great contribution of Thurstone to factor analysis was his proof that the rank of a matrix determined the minimum number of factors needed to account for the correlation matrix. Since the rank of a matrix is, in turn, affected by the communality estimates, this problem is related to the previous one.

A fourth problem concerns the rotation of the factors. Each factor can be represented geometrically as an axis, with each original variable having a projection on it. This projection corresponds to the factor loading. In the initial extraction of factors, an arbitrary set of axes is established. The positions of these axes with reference to the original variables are accidental and usually difficult to interpret. The solution to this problem is to "rotate" the axes without changing the relative configuration of the original variables. It is thus necessary to establish some criteria to determine when "proper" rotation has been achieved. The best known criterion and probably the most meaningful for psychology, is Thurstone's "simple structure" criterion. "Simple structure" requires that:

1. Each row of the factor matrix should have at least one zero;
2. If there are m common factors, each column in the factor matrix should have at least m zeros;
3. For every pair of columns in the factor matrix, there should be several variables whose entries (factor loadings) vanish (approach zero) in one column but not in the other;
4. For every pair of columns in the factor matrix, a large proportion of the variables would have vanishing entries in both columns when there are four or more factors;
5. For every pair of columns in the factor matrix, there should be only a small number of variables with non-vanishing entries in both columns.

The rotational method used in this bulletin, Kaiser's varimax method, is one of those methods of rotation which adequately fulfills the simple structure criterion.

What is to be gained from factor analysis? First it is possible to determine how variables group or co-vary by examining the pattern of factor loadings. Secondly, once a discipline has developed to the stage where its significant variables have been identified it is possible with the help of factor analysis to locate new variables, i.e., the underlying factors. That is, it is possible to view the factors as dimensions underlying the variables in question. Finally, once factors have been named and defined in operational (measurement) terms, communication is facilitated. It is easier to communicate about a limited number of concepts than about a large matrix of variables. For these reasons, factor analysis has become a powerful and indispensable tool for the social scientist.

Reliability

The concept of reliability is relatively well established in psychological literature. "Reliability" is generally defined as the complement of error variance. Error variance is that part of the total variance which cannot be reproduced. The presence of error variance thus corresponds to the existence of a certain amount of unreliability in the measuring instrument. After subtracting error variance, the remaining portion of the total variance is known as "true" variance. That is,

$$V_{tot} = V_t + V_e \tag{3}$$

where V_{tot} is total variance, V_t stands for true variance and V_e for error variance.

Reliability, r_{11}, is defined as:

$$r_{11} = \frac{V_t}{V_{tot}} \tag{4}$$

That is, the reliability coefficient is the ratio of the true variance to the total variance.

The basic problem in defining reliability is that of determining which components of the total variance to consider as true variance. One of the most useful guides to this end is Thorndike's *Personnel Selection*. Thorndike discusses in detail five major sources of variance and their relation to reliability.

The variance in a set of scores arises principally because different individuals possess varying amounts of certain **general and persistent** characteristics. Into this category Thorndike places general level of ability, which may enter into many different performance measures, and verbal comprehension, which may enter into how well an individual performs on paper and pencil tasks and understands the instructions in the tests. This variance is due to **lasting** characteristics of the individual, and therefore, should be treated as true variance. It is **general** in the sense that it has an impact on a number of different tests or tasks.

Some variance may arise out of the persistent or lasting characteristics of the individual but yet is specific to the particular test or task. This is called **lasting and specific variance.** It may arise out of special knowledge and skills necessary to taking this particular form of test. It may also arise out of the particular sampling of test items. Here is encountered the problem of deciding which part is true variance and which part is error variance. In general, variance due to specific abilities or skills and variance due to knowledge and skills necessary to taking the particular test are true variance, while variance due to the particular sampling of items and test format is treated as error variance. This points up the fact that there is no single correct reliability coefficient for any test. It will depend on the purposes of the test-user, method of development, content area and several other conditions that will vary with test usage.

A third set of factors which Thorndike believes produces variation in test scores are **general but temporary characteristics of the individual.** Some of these may be the person's state of health, the effect of the weather, the stress of the situation, etc. These factors more or less reflect the individual's "psychological mood" at the time of taking the test. Some of these factors are more general than others, and some are more permanent than others. The question thus arises

as to how permanent and general do the factors have to be before they can be considered as sources of true variance. The answer depends on the particular research in question, i.e., how much significance such factors are liable to have on the total variance. This must be answered empirically, not by conjecture.

A fourth group of factors contributing to variation in test performance consists of **temporary and specific factors.** One such factor is practice. The practice factor becomes important in some manual tests or tests which have a unique pattern. Thorndike mentions the fact that the presence or significance of such factors in most tests is open to question. Variance due to this source is usually treated as error variance in most personnel research.

Thorndike's last category is **"variance not otherwise accounted for, or chance variance."** This is error variance in its purest form.

While there is general agreement on the conceptual or logical definition of reliability, there is less consensus on operational definition or measurement. The estimation of reliability has been the subject of much discussion because the operations used to estimate reliability do not necessarily correspond to the conceptual meaning intended.

Reliability is generally estimated through one of three types of procedures which define reliability in terms of a) stability, b) alternate test performance, and c) internal consistency.

a) Stability measures answer the question of how stable an individual's responses are over a period of time. High reliability of this type means that individuals maintain their relative positions on the scale in spite of the passing of time. A low "test-retest" reliability means that responses to the instrument have been differentially affected by events occurring between the two administrations.

b) If an individual performs equally well on alternate test forms, his performance is said to be reliable. Gulliksen defines alternate or parallel test forms as two forms of the same instrument which have identical means, variances, and correlations with other forms.[10] Alternate test performance is an index of how equivalent the measured content of one form is with the content of the other form. Guilford believes that the nearer the two forms are administered in time, the more nearly does alternate test performance become an index of internal consistency.[11] The farther apart the two forms are administered in time, the more nearly does alternate test performance approximate a measure of stability.

c) Internal consistency refers to the consistency with which individuals respond to the set of different test items. Consistency of response yields systematic or true variance; inconsistency is reflected in error variance.

There are at least two ways of measuring internal consistency. The first is to subdivide the items into two groups on an odd-even basis or some other basis, and correlate the resulting two scores. The second method, and the one chosen for use in this bulletin, is to separate the different components of variance and determine the error variance. The most acceptable procedure for analyzing test variance in this manner has been developed by C. J. Hoyt.[12]

Hoyt assumes that the score of an individual on a test may be divided into four independent components:

1. A component common to all individuals and to all items, or the interaction of individuals and items.

2. A component common to the item.

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[10] Gulliksen, H. *Theory of Mental Tests.* New York: Wiley, 1950.

[11] Guilford, J. P. *Fundamental Statistics in Psychology and Education.* New York: McGraw-Hill Book Company, Inc., 1956.

[12] See footnote 7, p. 28.

3. A component common to the individual.

4. The error component that is independent of the previous components. The error component is assumed to be normally distributed, the error variance in each item is assumed to be constant, and the error variance for any two items is independent.

When these conditions are met it is possible to partition the variance into the latter three categories. Reliability is then defined by the following relation:

$$r_{11} = \frac{\text{variance due to individuals—error variance}}{\text{variance due to individuals}}$$

This results in the variance due to the differences in responses among individuals. The interaction of items and individuals and the error variance is taken out in a single term.

The assumptions underlying the analysis of variance approach to test reliability are as follows:

1. The instrument is assumed to be homogeneous. That is, the variance of each item is assumed to be equal. No variance is special to subsets of items.

2. As mentioned earlier, the error variance of each item is assumed to be independent of other variance components.

3. All items in the instrument must be attempted. This means that the procedure will not work for speed tests (i.e., time-limit tests).

4. Any method based upon a single administration allocates to the true or systematic variance the day-to-day fluctuations in the individuals performance.

The majority of the tests developed today are designed to be internally consistent. For this reason the reliability coefficient is usually the minimum information that is reported on a paper-and-pencil measuring device. A high reliability usually indicates how well the test constructor has approached his goal of internal consistency. A high reliability coefficient is usually desirable, but under special circumstances somewhat lower reliabilities may be acceptable. In addition to the degree of reliability that an instrument has, it is necessary to determine the amount of common variance which an instrument has in common with the prescribed common factor. Finally, for research purposes, it is possible to tolerate lower reliability than is required for diagnostic or prognostic purposes.

This appendix has only begun to touch the problem of reliability. For much more complete discussions, see Gulliksen,[13] Guilford,[14] and Thorndike.[15]

[13] See footnote 10, p. 50.

[14] See footnote 11, p. 50.

[15] Thorndike, R. L. *Personnel Selection: Test and Measurement Techniques*. New York: John Wiley and Sons, Inc., 1949.

APPENDIX A

Industrial Relations Center
University of Minnesota

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SUPERVISOR REPORT

TO THE SUPERVISOR: As part of our study of what makes a good worker, we need your answers to the following questions. What we are interested in is your evaluation of the employee named. If this person no longer works for you, please check the box which applies:

☐ quit ☐ fired ☐ laid off ☐ transferred to another department

If he still works for you, please check one box under each of the following ten questions.

Employee:_____

1. Compared to the rest of the men in his work group, how much is he absent from work? (Check one)

☐	☐	☐	☐	☐
much less	less	about average	more	much more

2. Compared to others in his group, how many times is he late for work?

☐	☐	☐	☐	☐
many more	more	about the same as others	less	much less

3. How does his accident record compare with his fellow workers?

☐	☐	☐	☐	☐
much worse	worse	about the same	better	much better

4. Compared to others in his group, how frequently does he need disciplinary action?

☐	☐	☐	☐	☐
never	almost never	once in awhile	often	very often

☐	☐	☐	☐	☐

5. Do you think he would do better if he were on some other kind of job?

☐	☐	☐	☐	☐
definitely yes	yes	I'm not sure	no	definitely no

6. How does the quality of his work compare with others?

☐	☐	☐	☐	☐
much worse	worse	about the same	better	much better

7. Would you consider him for a promotion to a position of more responsibility if you could make the decision?

☐	☐	☐	☐	☐
definitely not	probably not	I'm not sure	probably yes	definitely yes

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8. If the decision were up to you, would you give him a raise in pay right now?

☐	☐	☐	☐	☐
definitely not	probably not	I'm not sure	probably yes	definitely yes

9. Check the group most true of this worker:

☐ Thoroughly settled down
Never have to worry about him
No trouble to me at all
Well adjusted to the job

☐ Has settled down better than average
Seldom need to worry about him
Not much trouble to me
Fairly well adjusted to the job

☐ Average

☐ Has settled down less well than average
Quite often have to worry about him
Is a lot of trouble to me
Not very well adjusted to the job

☐ Has never really settled down
Always have to worry about him
One of my headaches
Poorly adjusted to the job

*10. Now will you please consider this worker with respect to his over-all competence, the effectiveness with which he performs his job, his proficiency, his general over-all value. Take into account all the elements of successful job performance, such as knowledge of the job and functions performed, quantity and quality of output, relations with other people (subordinates, equals, superiors), ability to get the work done, intelligence, interest, response to training, and the like. In other words, how closely does he approximate the ideal, the kind of worker you want more of? With all these factors in mind, where would you rank this worker as compared with the other people whom you now have doing the same work—or if he is the only one, how does he compare with those who have done the same work in the past?

☐ In the top ¼

☐ In the top half but not among the top ¼

☐ In the bottom half but not among the lowest ¼

☐ In the lowest ¼

Form F-3 Co.:

* This item replaced the Personnel Evaluation Sheet (alternation ranking) in mail follow-up questionnaire surveys conducted after initial contact with the firm.

Industrial Relations Center
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PERSONNEL RECORDS REPORT

Employee:_____

1. Absences:

definition: **An employee is considered absent from work if he is away from his job for a half-day or more, on any given day.**

question: **1. How many times has he been absent from work in the last month?** _____ ☐ no records

2. Lateness:

definition: **An employee is late if the time at which he begins work is after the customary time at which work is usually begun—and it results in a deduction from his pay.**

question: **2. How many times has he been late in the last month?** _____ ☐ no records

3. Accidents:

definition: **major accident**—a major accident is where the accident results in lost time of one or more days following the accident.

minor accident—a minor accident involves lost time only on the day on which the accident occurs.

question: **3a. How many major accidents has he had in the last month?** _____ a. ☐ no records

3b. How many minor accidents has he had in the last month? _____ b. ☐ no records

4. Discipline:

definition: **major disciplinary action**—this occurs when an employee breaks an existing work rule and he is given a written reprimand or even more serious punishment.

minor disciplinary action—when breaking a work rule results in a verbal reprimand by the supervisor with no further punishment involved.

question: **4a. How many major disciplinary actions has he had in the last month?** _____ a. ☐ no records

4b. How many minor disciplinary actions has he had in the last month? _____ b. ☐ no records

Form F-2 Co.:

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PERSONNEL EVALUATION SHEET

This is a simple evaluation sheet. All you need do to complete the rating is to follow the directions outlined in the six steps that follow. Be sure to finish each step before going into the next one.

Step 1:

List the names of the persons you are going to rate in alphabetical order on the left hand side of page 2. Do not include yourself or any person whose work is unique or so different that a comparison with the group is not appropriate.

Step 2:

Now will you please consider these people with respect to their over-all competence, the effectiveness with which they perform their jobs, their proficiency, their general over-all value. Ask yourself such questions as: Which one of them is the most successful, most competent, most effective, most valuable of the group? Take into account all the elements of successful job performance, such as knowledge of the job and functions performed, quantity and quality of output, relations with other people (subordinates, equals, superiors), ability to get the work done, intelligence, interest, response to training, and the like. In other words, which one most nearly approximates the ideal, the kind you want more of.

Study names and decide which one person "tops" the list, that is, which one is "best" or "highest" in terms of the criterion described above.

Cross this name off the list and write it on the top line, the line marked "Highest-1" on the right hand side of page 2.

Step 3:

Now study the remaining names and decide which one person is "lowest," that is, which one is poorest or least successful of the group. This does not mean that the person is satisfactory; there may be no unsatisfactory or really low individuals in the list, but someone must be at the bottom of any group.

Cross this name off the left-hand-side list and write it on the bottom line, right-hand-side, the one marked "Lowest-1."

Step 4:

Now select the "next highest" from the remaining names, cross it off and write it on the line marked "Next Highest-2."

Step 5:

Then select the person next to the lowest of the group, cross that name off and write it on the line marked "Next Lowest-2."

Step 6:

Repeat this process, alternating between highest and lowest until all names have been crossed off the left-hand list.

Table A-2

List persons to be rated here:	Rank them here:
1. _____	Highest-1 _____
2. _____	Next Highest-2 _____
3. _____	Next Highest-3 _____
4. _____	Next Highest-4 _____
5. _____	Next Highest-5 _____
6. _____	Next Highest-6 _____
7. _____	Next Lowest-6 _____
8. _____	Next Lowest-5 _____
9. _____	Next Lowest-4 _____
10. _____	Next Lowest-3 _____
11. _____	Next Lowest-2 _____
12. _____	Lowest-1 _____

APPENDIX B

Table B-1. Distribution of responses, by group, for the absence item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.	4	15	58	41	45	163	597	3.66
II.	1	8	90	46	40	185	671	3.63
III.	1	7	46	22	14	90	311	3.46
IV.		9	62	18	22	111	386	3.48
V.	5	10	54	24	35	128	458	3.58
VI.	1	8	52	28	23	112	400	3.57
VII.	5	13	50	14	26	108	367	3.40
VIII.		5	52	15	16	88	306	3.48
Total Handicapped						489	1733	3.54
Total Control						496	1763	3.55
Grand Total						985		

Table B-2. Distribution of responses, by group, for the lateness item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.	2	4	75	37	45	163	608	3.73
II.	1	7	87	47	43	185	679	3.67
III.	2	4	47	16	21	90	320	3.56
IV.	1	9	57	21	23	111	389	3.50
V.		9	46	34	39	128	487	3.80
VI.	1	8	43	33	27	112	413	3.69
VII.	6	8	45	21	28	108	381	3.53
VIII.	1	3	50	18	16	88	309	3.51
Total Handicapped						489	1796	3.67
Total Control						496	1790	3.61
Grand Total						985		

Table B-3. Distribution of responses, by group, for the accidents item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.	2	13	90	34	24	163	554	3.40
II.	1	6	91	58	29	185	663	3.58
III.		5	61	16	8	90	297	3.30
IV.		5	69	17	20	111	385	3.47
V.		4	89	15	20	128	435	3.40
VI.			83	9	20	112	385	3.44
VII.		1	79	9	19	108	370	3.43
VIII.		2	72	5	9	88	285	3.24
Total Handicapped						489	1656	3.39
Total Control						496	1718	3.46
Grand Total						985		

Table B-4. Distribution of responses, by group, for the disciplinary action item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.		7	61	57	38	163	615	3.77
II.	2	6	53	78	46	185	715	3.86
III.		1	24	39	26	90	360	4.00
IV.		7	30	41	33	111	433	3.90
V.		6	29	57	36	128	507	3.96
VI.		3	25	42	42	112	459	4.10
VII.	1	1	36	32	38	108	429	3.97
VIII.		3	17	35	33	88	362	4.11
Total Handicapped						489	1911	3.91
Total Control						496	1969	3.97
Grand Total						985		

Table B-5. Distribution of responses, by group, for the job suitability item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.	1	13	59	74	16	163	580	3.56
II.	2	20	54	97	12	185	652	3.52
III.		6	28	44	12	90	332	3.69
IV.	1	8	31	63	8	111	402	3.62
V.	1	14	41	57	15	128	455	3.55
VI.	1	10	35	54	12	112	402	3.59
VII.	4	9	26	55	14	108	390	3.61
VIII.	1	7	17	49	14	88	332	3.77
Total Handicapped						489	1757	3.59
Total Control						496	1788	3.60
Grand Total						985		

Table B-6. Distribution of responses, by group, for the quality of work item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.	1	15	94	37	16	163	541	3.32
II.		20	75	63	27	185	652	3.52
III.		7	45	29	9	90	310	3.44
IV.		9	52	33	17	111	391	3.52
V.	1	16	53	39	19	128	443	3.46
VI.	1	4	46	35	26	112	417	3.72
VII.	1	12	43	34	18	108	380	3.52
VIII.		9	34	30	15	88	315	3.58
Total Handicapped						489	1674	3.42
Total Control						496	1775	3.58
Grand Total						985		

Table B-7. Distribution of responses, by group, for the promotability item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.	23	58	28	40	14	163	453	2.78
II.	23	51	37	52	22	185	554	2.99
III.	8	31	13	24	14	90	275	3.06
IV.	19	33	9	35	15	111	327	2.95
V.	16	35	19	37	21	128	396	3.17
VI.	7	29	16	37	23	112	376	3.36
VII.	6	27	9	36	29	108	376	3.48
VIII.	5	27	7	31	18	88	294	3.34
Total Handicapped						489	1510	3.09
Total Control						496	1551	3.13
Grand Total						985		

Table B-8. Distribution of responses, by group, for the pay raise item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.	29	62	27	29	16	163	430	2.64
II.	34	56	32	42	21	185	515	2.78
III.	18	30	10	23	9	90	245	2.72
IV.	25	29	19	26	12	111	304	2.74
V.	14	39	14	41	20	128	398	3.11
VI.	11	27	12	45	17	112	366	3.27
VII.	13	26	14	29	26	108	353	3.27
VIII.	13	20	9	27	19	88	283	3.22
Total Handicapped						489	1426	2.92
Total Control						496	1468	2.96
Grand Total						985		

Table B-9. Distribution of responses, by group, for the Heron adjustment criterion item

Group	Responses					Summary Statistics		
	1	2	3	4	5	N	Σx	M
I.	4	18	45	47	49	163	608	3.73
II.	4	12	48	42	79	185	735	3.97
III.	1	7	21	30	31	90	353	3.92
IV.		8	33	33	37	111	432	3.89
V.	3	10	35	38	42	128	490	3.83
VI.		8	26	31	47	112	453	4.04
VII.	1	9	23	34	41	108	429	3.97
VIII.	1	3	23	24	37	88	357	4.06
Total Handicapped						489	1880	3.84
Total Control						496	1977	3.99
Grand Total						985		

Table B-10. Distribution of responses, by group, for the alternation ranking

Group	Categories			Summary Statistics		
	1	2	3	N	Σx	M
I. Handicapped, nonskilled blue-collar	52	76	35	163	309	1.90
II. Control, nonskilled blue-collar	41	79	65	185	394	2.13
III. Handicapped, skilled blue-collar	28	37	25	90	177	1.97
IV. Control, skilled blue-collar	34	43	34	111	222	2.00
V. Handicapped, nonskilled white-collar	46	45	37	128	247	1.93
VI. Control, nonskilled white-collar	30	40	42	112	236	2.11
VII. Handicapped, skilled white-collar	35	31	42	108	223	2.06
VIII. Control, skilled white-collar	23	33	32	88	185	2.10
Total Handicapped				489	956	1.96
Total Control				496	1037	2.09
Grand Total				985	1993	

APPENDIX C

Table C-1

Analysis of variance table for absence item

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0004	.0004	.049
Occupation	3	.0555		
Collar	1	.0048	.0048	.585
Skill	1	.0497	.0497	6.061*
Residual	1			
Interaction	3	.0036	.0012	.146
Error	977	8.0258	.0082	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-2

Analysis of variance table for lateness item

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0075	.0075	.926
Occupation	3	.0810		
Collar	1	.0006	.0006	.074
Skill	1	.0788	.0788	9.728**
Residual	1			
Interaction	3	.00263	.0009	.111
Error	977	7.8693	.0081	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-3

Analysis of variance table for accident item

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0053	.0053	.964
Occupation	3	.0266		
Collar	1	.0079	.0079	1.436
Skill	1	.0185	.0185	3.364
Residual	1			
Interaction	3	.0442	.0147	2.673
Error	977	5.3425	.0055	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-4

Analysis of variance table for discipline item

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0091	.0091	1.444
Occupation	3	.0634		
Collar	1	.0459	.0459	7.286**
Skill	1	.0105	.0105	1.667
Residual	1			
Interaction	3	.0274	.0091	1.444
Error	977	6.1659	.0063	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-5

Analysis of variance table for job suitability item

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0011	.0011	.183
Occupation	3	.0296		
Collar	1	.0023	.0023	.383
Skill	1	.0273	.0273	4.550*
Residual	1			
Interaction	3	.0153	.0051	.850
Error	977	5.8462	.0060	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-6

Analysis of variance table for promotability item

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0028	.0028	.209
Occupation	3	.3448		
Collar	1	.2367	.2367	17.664**
Skill	1	.0338	.0338	2.522
Residual	1			
Interaction	3	.0536	.0179	1.336
Error	977	13.1328	.0134	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-7

Analysis of variance table for quality of work item

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0461	.0461	7.317**
Occupation	3	.0334		
Collar	1	.0277	.0277	4.397*
Skill	1	.0002	.0002	.032
Residual	1			
Interaction	3	.0144	.0048	.762
Error	977	6.1354	.0063	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-8

Analysis of variance table for the pay raise item

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0088	.0088	.564
Occupation	3	.4923		
Collar	1	.4891	.4891	31.353**
Skill	1	.0027	.0027	.173
Residual	1			
Interaction	3	.0157	.0052	.333
Error	977	15.211	.0156	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-9

Analysis of variance table for Heron adjustment criterion

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0326	.0326	3.622
Occupation	3	.0277		
Collar	1	.0185	.0185	2.056
Skill	1	.0079	.0079	.878
Residual	1			
Interaction	3	.0240	.0080	.889
Error	977	8.8417	.0090	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table C-10

Analysis of variance table for alternation ranking

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0290	.0290	5.577*
Occupation	3	.0110		
Collar	1	.0056	.0056	1.077
Skill	1	.0007	.0007	.135
Residual	1			
Interaction	3	.0003	.0001	.019
Error	977	5.114	.0052	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

APPENDIX D

Table D-1. Item intercorrelation matrix. Group I: Handicapped, nonskilled blue-collar (N = 163)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Absence									
2. Lateness	61								
3. Accident	47	48							
4. Disciplinary action	24	23	35						
5. Job suitability	15	28	17	16					
6. Quality of work	39	45	52	35	25				
7. Promotability	31	13	24	33	−06	37			
8. Pay raise	35	23	25	26	02	52	56		
9. Heron adjustment criterion	38	26	41	47	15	49	49	47	
10. Alternation ranking	35	28	35	37	13	56	39	44	44

Note: decimal points omitted.

Table D-2. Item intercorrelation matrix. Group II: Control, nonskilled blue-collar (N = 185)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Absence									
2. Lateness	71								
3. Accident	45	41							
4. Disciplinary action	34	36	31						
5. Job suitability	17	22	13	16					
6. Quality of work	42	37	38	58	12				
7. Promotability	23	17	23	50	−01	61			
8. Pay raise	21	18	26	40	03	57	71		
9. Heron adjustment criterion	35	33	33	55	08	50	50	39	
10. Alternation ranking	31	19	15	39	00	51	51	37	49

Note: decimal points omitted.

Table D-3. Item intercorrelation matrix. Group III: Handicapped, skilled blue-collar (N = 90)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Absence									
2. Lateness	69								
3. Accident	39	50							
4. Disciplinary action	21	19	18						
5. Job suitability	14	35	13	27					
6. Quality of work	35	38	28	33	32				
7. Promotability	20	26	24	30	22	43			
8. Pay raise	27	30	22	34	22	40	59		
9. Heron adjustment criterion	31	38	24	49	33	39	48	43	
10. Alternation ranking	12	28	16	13	20	44	30	33	26

Note: decimal points omitted.

Table D-4. Item intercorrelation matrix. Group IV: Control, skilled blue-collar (N = 111)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Absence									
2. Lateness	69								
3. Accident	61	65							
4. Disciplinary action	39	34	29						
5. Job suitability	25	22	28	42					
6. Quality of work	45	43	44	47	18				
7. Promotability	29	33	38	54	21	56			
8. Pay raise	23	29	27	44	00	52	74		
9. Heron adjustment criterion	46	40	48	65	39	51	60	41	
10. Alternation ranking	31	26	25	46	23	56	58	43	47

Note: decimal points omitted.

Table D-5. Item intercorrelation matrix. Group V: Handicapped, nonskilled white-collar (N = 128)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Absence									
2. Lateness	64								
3. Accident	46	52							
4. Disciplinary action	29	38	25						
5. Job suitability	17	17	09	13					
6. Quality of work	27	43	17	45	28				
7. Promotability	32	39	18	40	15	65			
8. Pay raise	33	29	15	32	29	46	59		
9. Heron adjustment criterion	34	42	19	55	25	54	39	38	
10. Alternation ranking	23	22	04	19	19	50	40	29	29

Note: decimal points omitted.

Table D-6. Item intercorrelation matrix. Group VI: Control, nonskilled white-collar (N = 112)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Absence									
2. Lateness	60								
3. Accident	50	55							
4. Disciplinary action	36	36	24						
5. Job suitability	19	22	07	26					
6. Quality of work	24	40	14	40	40				
7. Promotability	16	21	12	43	23	61			
8. Pay raise	21	32	27	30	25	56	58		
9. Heron adjustment criterion	18	33	21	57	28	62	54	48	
10. Alternation ranking	11	16	08	31	28	60	50	49	54

Note: decimal points omitted.

Table D-7. Item intercorrelation matrix. Group VII: Handicapped, skilled white-collar (N = 108)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Absence									
2. Lateness	71								
3. Accident	52	61							
4. Disciplinary action	39	39	33						
5. Job suitability	37	34	25	35					
6. Quality of work	41	46	46	34	42				
7. Promotability	36	38	37	51	35	57			
8. Pay raise	48	38	34	44	27	37	69		
9. Heron adjustment criterion	42	40	33	61	43	50	65	50	
10. Alternation ranking	39	37	38	44	38	44	43	35	44

Note: decimal points omitted.

Table D-8. Item intercorrelation matrix. Group VIII: Control, skilled white-collar (N = 88)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Absence									
2. Lateness	67								
3. Accident	36	46							
4. Disciplinary action	−01	03	12						
5. Job suitability	04	16	10	31					
6. Quality of work	39	35	48	42	36				
7. Promotability	16	15	16	46	23	50			
8. Pay raise	14	02	20	32	17	44	69		
9. Heron adjustment criterion	11	10	29	58	41	55	65	52	
10. Alternation ranking	17	16	22	35	44	49	48	28	49

Note: decimal points omitted.

APPENDIX E

Table E-1. Analysis of variance table for performance scale

Source	Degrees of freedom	Sum of squares	Mean square	F_r
Sample	1	.1507	.1507	1.051
Occupation	3	4.4806		
Collar	1	3.8448	3.8448	26.812**
Skill	1	.5629	.5629	3.925*
Residual	1			
Interaction	3	.4314	.1438	1.003
Error	977	140.0925	.1434	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

Table E-2. Analysis of variance table for conformance scale

Source	Degrees of freedom	Sum of squares	Mean square	F
Sample	1	.0000	.0000	.0000
Occupation	3	.4268		
Collar	1	.0178	.0178	.393
Skill	1	.4091	.4091	9.031**
Residual	1			
Interaction	3	.0251	.0084	.185
Error	977	44.2331	.0453	

* Significant at $.01 < P \leq .05$.
** Significant at $P \leq .01$.

APPENDIX F

Table F-1. Satisfaction and satisfactoriness scale intercorrelation matrix for Group I: Handicapped, nonskilled blue-collar (N = 163)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Performance							
2. Conformance	49						
3. Working conditions	07	−02					
4. Supervision	20	09	56				
5. Compensation	01	05	42	34			
6. Co-workers	14	05	15	36	15		
7. Sensitivity	15	07	26	23	23	14	
8. General job satisfaction	14	13	54	55	47	25	25

Note: decimal points omitted.

Table F-2. Satisfaction and satisfactoriness scale intercorrelation matrix for Group II: Control, nonskilled blue-collar (N = 185)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Performance							
2. Conformance	42						
3. Working conditions	−02	09					
4. Supervision	−09	06	53				
5. Compensation	−12	14	44	51			
6. Co-workers	−09	07	56	45	48		
7. Sensitivity	−04	07	37	27	36	54	
8. General job satisfaction	−01	12	54	50	65	47	45

Note: decimal points omitted.

Table F-3. Satisfaction and satisfactoriness scale intercorrelation matrix for Group III: Handicapped, skilled blue-collar (N = 90)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Performance									
2. Conformance	44								
3. Working conditions	06	−03							
4. Supervision	33	10	37						
5. Compensation	−01	−10	14	43					
6. Co-workers	06	09	56	08	−06				
7. Sensitivity	20	18	38	43	18	23			
8. Company	−02	−05	63	50	42	36	60		
9. Type of work	02	03	37	28	19	48	35	60	
10. General job satisfaction	30	13	26	61	47	10	38	50	37

Note: decimal points omitted.

Table F-4. Satisfaction and satisfactoriness scale intercorrelation matrix for Group IV: Control, skilled blue-collar (N = 111)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Performance								
2. Conformance	48							
3. Working conditions	12	09						
4. Supervision	07	01	52					
5 Compensation	07	03	28	49				
6. Co-workers	21	16	34	35	33			
7. Sensitivity	26	11	01	12	01	34		
8. Company	15	16	47	53	50	25	−12	
9. General job satisfaction	23	12	27	45	54	20	03	62

Note: decimal points omitted.

Table F-5. Satisfaction and satisfactoriness scale intercorrelation matrix for Group V: Handicapped, nonskilled white-collar (N = 128)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Performance							
2. Conformance	47						
3. Working conditions	−06	−05					
4. Supervision	11	15	53				
5. Compensation	07	12	35	42			
6. Co-workers	07	18	13	60	16		
7. Sensitivity	09	04	08	24	23	13	
8. General job satisfaction	14	18	37	60	52	42	33

Note: decimal points omitted.

Table F-6. Satisfaction and satisfactoriness scale intercorrelation matrix for Group VI: Control, nonskilled white-collar (N = 112)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Performance							
2. Conformance	30						
3. Working conditions	31	05					
4. Supervision	14	−05	25				
5. Compensation	14	−07	41	35			
6. Co-workers	−12	−18	08	03	10		
7. Sensitivity	13	03	16	23	13	00	
8. General job satisfaction	24	−04	20	09	21	05	33

Note: decimal points omitted.

Table F-7. Satisfaction and satisfactoriness scale intercorrelation matrix for Group VII: Handicapped, skilled white-collar (N = 108)

	(1)	(2)	(3)	(4)	(5)	(6)
1. Performance						
2. Conformance	58					
3. Working conditions	16	23				
4. Supervision	23	13	29			
5. Compensation	31	19	41	34		
6. Co-workers	−05	−06	25	34	10	
7. General job satisfaction	43	27	36	66	53	31

Note: decimal points omitted.

Table F-8. Satisfaction and satisfactoriness scale intercorrelation matrix for Group VIII: Control, skilled white-collar (N = 88)

	(1)	(2)	(3)	(4)	(5)	(6)
1. Performance						
2. Conformance	33					
3. Working conditions	03	−11				
4. Supervision	17	02	34			
5. Compensation	05	−02	45	45		
6. Co-workers	15	01	26	59	38	
7. General job satisfaction	00	00	39	44	69	40

Note: decimal points omitted.

APPENDIX G

Industrial Relations Center
University of Minnesota

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SUPERVISOR REPORT

TO THE SUPERVISOR: As part of our study of what makes a good worker, we need your answers to the following questions. What we are interested in is your evaluation of the employee named. If this person no longer works for you, please check the box which applies:

☐ quit ☐ fired ☐ laid off ☐ transferred to another department

If he still works for you, please check one box under each of the following nine questions.

Employee:_____

1. Compared to the rest of the men in his work group, how much is he absent from work? (Check one)

1	2	3	4	5
☐	☐	☐	☐	☐
much less	less	about average	more	much more

2. Compared to others in his group, how many times is he late for work?

5	4	3	2	1
☐	☐	☐	☐	☐
many more	more	about the same as others	less	much less

3. How does his accident record compare with his fellow workers?

1	2	3	4	5
☐	☐	☐	☐	☐
much worse	worse	about the same	better	much better

4. Compared to others in his group, how frequently does he need disciplinary action?

1	2	3	4	5
☐	☐	☐	☐	☐
never	almost never	once in awhile	often	very often

5. Do you think he would do better if he were on some other kind of job?

5	4	3	2	1
☐	☐	☐	☐	☐
definitely yes	yes	I'm not sure	no	definitely no

6. How does the quality of his work compare with others?

1	2	3	4	5
☐	☐	☐	☐	☐
much worse	worse	about the same	better	much better

7. Would you consider him for a promotion to a position of more responsibility if you could make the decision?

1	2	3	4	5
☐	☐	☐	☐	☐
definitely not	probably not	I'm not sure	probably yes	definitely yes

8. If the decision were up to you, would you give him a raise in pay right now?

1	2	3	4	5
☐	☐	☐	☐	☐
definitely not	probably not	I'm not sure	probably yes	definitely yes

9. Check the group most true of this worker:

5 ☐ Thoroughly settled down
Never have to worry about him
No trouble at all
Well adjusted to the job

4 ☐ Has settled down better than average
Seldom need to worry about him
Not much trouble to me
Fairly well adjusted to the job

3 ☐ Average

2 ☐ Has settled down less well than average
Quite often have to worry about him
Is a lot of trouble to me
Not very well adjusted to the job

1 ☐ Has never really settled down
Always have to worry about him
One of my headaches
Poorly adjusted to the job

Form F-3 Co.:

APPENDIX H

Table H-1. Percentile scores, means and standard deviations for the performance scale scores, by group

Percentile	Group[a] I	II	III	IV	V	VI	VII	VIII
				Raw scores				
100	23	23	23	22	22	23	23	23
95	20	22	21	21	21	22	22	22
90	19	21	20	20	20	21	21	22
85	19	20	19	19	19	21	20	21
80	18	19	18	18	18	20	19	20
75	17	18	17	17	17	20	18	19
70	16	18	17	16	16	19	17	19
65	15	17	16	16	16	18	17	18
60	14	16	16	15	15	18	17	18
55	14	15	15	15	14	17	16	17
50	13	14	15	14	13	17	15	16
45	13	14	14	13	13	16	15	16
40	13	14	14	12	13	16	14	15
35	12	14	13	11	12	15	14	15
30	12	13	13	11	12	14	14	14
25	11	12	12	10	11	13	13	13
20	11	11	11	10	10	12	12	12
15	10	10	10	10	10	11	11	11
10	9	9	10	9	8	10	10	10
5	8	8	9	8	6	9	7	9
Mean	14.36	14.41	15.11	15.10	15.42	16.50	16.31	16.30
Standard deviation	3.87	4.81	3.78	4.25	4.07	4.14	4.30	4.19

[a] See footnote a, Tables 1 & 2, pp. 10, 12.

Table H-2. Percentile scores, means and standard deviations for the conformance scale scores, by group

Percentile	Group[a] I	II	III	IV	V	VI	VII	VIII
				Raw scores				
100	15	15	15	15	15	14	14	15
95	14	14	14	14	15	14	14	15
90	14	13	13	13	14	14	14	14
85	13	13	12	12	13	14	13	13
80	12	12	11	12	12	13	12	12
75	12	12	11	11	12	12	12	11
70	12	11	10	10	11	11	11	10
65	11	11	10	10	10	11	10	10
60	11	11	9	9	10	10	10	9
55	10	10	9	9	10	10	9	9
50	10	10	9	8	10	10	9	8
45	9	9	8	8	9	9	8	8
40	9	9	8	8	9	9	8	8
35	9	9	8	8	8	8	8	8
30	8	8	8	8	8	8	8	8
25	8	8	8	8	8	8	8	8
20	8	8	8	8	8	8	8	8
15	8	8	8	8	8	8	8	8
10	8	8	8	7	8	8	7	8
5	7	8	7	7	7	7	6	8
Mean	10.79	10.88	10.31	10.45	10.78	10.70	10.35	10.23
Standard deviation	2.38	2.15	2.29	2.35	2.38	2.22	2.56	1.97

[a] See footnote a, Tables 1 & 2, pp. 10, 12.