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ABSTRACT

The primary purpose of this study was to obtain estimates of the human attribute requirements of the job elements of the Position Analysis Questionnaire (PAQ). A secondary purpose was to explore the reliability of job-related ratings as a function of the number of raters. A taxonomy of 76 human attributes was used and ratings of the relevance of these attributes to each of the PAQ job elements were obtained. Conclusions drawn from these analyses were: (1) Raters are able to rate the relevance of human attributes to job elements in a structured job analysis instrument such as the PAQ with respectable reliability, and (2) A large number of human attributes appear to be relevant to the job elements of the PAQ. Implications drawn from these conclusions were: (1) The attribute profiles of the PAQ job elements seem to be of potential use in determining job attribute requirements through job analysis with the PAQ, and (2) Such profiles, in turn, may be useful in establishing the synthetic validity of personnel tests. The determination of the reliability of the ratings as a function of the number of raters resulted in the conclusion that 8 to 10 raters usually would provide reasonably reliable ratings. (Author/MF)

Attribute Ratings and Profiles of the Job Elements of the Position Analysis Questionnaire (PAQ)

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ATTRIBUTE RATINGS AND PROFILES OF THE JOB ELEMENTS OF THE POSITION ANALYSIS QUESTIONNAIRE (PAQ)

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13. ABSTRACT
The primary purpose of this study was to obtain estimates of the human attribute requirements of the job elements of Form B of the Position Analysis Questionnaire (PAQ). A secondary purpose was to explore the reliability of job-related ratings as a function of the number of raters. A taxonomy of 76 human attributes was used, and ratings of the relevance of these attributes to each of the PAQ job elements were obtained. A minimum of 8 raters and a maximum of 11 raters rated each of the attributes. The mean and median ratings for each attribute as it related to each job element were computed, these serving as the basis for the attribute profiles of the job elements. Measures of the reliability of the ratings were also obtained. The conclusions drawn from these analyses were: (1) Raters are able to rate the relevance of human attributes to the job elements in a structured job analysis instrument such as the PAQ, and do so with respectable reliability; and (2) a large number of human attributes appear to be relevant to one or more of the job elements of the PAQ, with some attributes being relevant to more job elements than others. The implications drawn from these conclusions were: (1) the attribute profiles of the job elements of the PAQ would seem to be of potential use as the basis for determining the attribute requirements of jobs, through job analysis with the PAQ; and (2) in turn, such profiles might be of use in the establishment of the synthetic validity of tests for use in personnel programs. The determination of the reliability of the ratings as a function of the number of raters was accomplished through the use of the Spearman-Brown formula, and this analysis resulted in the conclusion that 8 to 10 raters usually would provide ratings of reasonably adequate reliability.

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Ratings of job variables						
Reliability of job-related ratings						
Spearman-Brown prediction formula						
Synthetic validity						
Taxonomy of attributes						
Worker-oriented job variables						

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ABSTRACT

The primary purpose of this study was to obtain estimates of the human attribute requirements of the job elements of Form B of the Position Analysis Questionnaire (PAQ), a structured job analysis instrument based on a worker oriented approach. A secondary purpose was to explore the reliability of job related ratings as a function of the number of raters.

This study is part of a larger effort aimed at refining and updating a body of data relating to the PAQ, and was designed to complete the data base necessary for the development of attribute profiles for the job elements of the PAQ. (The present study was, in effect, an extension of a similar study with an earlier form of the PAQ, Form A.) A taxonomy of 76 human attributes was used, and ratings of the relevance of each of these attributes to each of the PAQ job elements were obtained. A minimum of 8 raters and a maximum of 11 raters rated each of the attributes. The mean and median ratings for each attribute as it related to each job element were computed, these serving as the basis for the attribute profiles of the job elements. Measures of the reliability of the ratings were also obtained. The conclusions drawn from these analyses were:

(1) Raters are able to rate the relevance of human attributes to the job elements in a structured job analysis instrument such as the PAQ, and do so with respectable reliability (the reliability coefficients of the pooled ratings generally ranged from .80 to the upper .90's).

(2) A large number of human attributes appear to be relevant to one or more of the job elements of the PAQ, with some attributes being relevant to more job elements than others.

The implications drawn from these conclusions were:

(1) The attribute profiles of the job elements of the PAQ would seem to be of potential use as the basis for determining the attribute requirements of jobs, through job analysis of jobs with the PAQ.

(2) In turn, such profiles might be of use in the establishment of the synthetic validity of tests for use in personnel programs in industry.

The determination of the reliability of the ratings as a function of the number of raters was accomplished by stepping-up the intra-class correlation coefficient for each attribute with the Spearman-Brown prediction formula to n's ranging from 2 raters through 20 raters, and the empirical checking of these step-ups by drawing subsamples of different n's and computing their reliability. The conclusion drawn from this analysis was that 8 to 10 raters usually would provide ratings of reasonably adequate reliability. Such a sample size was found to generally produce reliabilities in the .80's and .90's.

INTRODUCTION

One of the basic objectives of personnel psychology has been that of the selection and placement of individuals in jobs which they are capable of performing adequately. In order to accomplish this, psychologists have developed numerous tests which presumably measure a variety of human abilities, and have validated these tests against various job-related criteria. In carrying out these validations, the major thrust has been toward the establishment of empirical criterion-related validity of one or more tests for any given job. This has most commonly involved concurrent validity (using the present employee method of test validation), but sometimes has involved predictive validity (using the follow-up method of test validation). Both of these methods, however, are predicated on the availability of large numbers of individuals in any given job, and are faced with such problems as the attrition of employees or of a restriction of the range of scores within the sample, not to mention the problem of the cost of carrying out such validation. In addition, such traditional empirical validation approaches may be seen as lacking a degree of parsimony in the practical sense, as they generally must be carried out for each individual job in each specific situation.

In so far as one can hypothesize some underlying order to the world of human work, however, it would seem that those jobs which involve the same basic job-related behaviors should also require the same human attributes for successful performance. Thus, it seems reasonable to believe that in the identification of valid predictors for specific jobs one could move from the conventional dead-center approach of empirical validation in each job situation toward an approach based on validity generalization or synthetic validation (Lawshe, 1952; Balma, 1959; Ghiselli, 1959; McCormick, 1959). Such a shift should make possible a more parsimonious basis for the establishment of valid predictors, and also permit the establishment of valid predictors in cases where it has not previously been possible or practical to do so. This shift would also be in the direction of identifying those human attributes that predispose individuals to perform effectively on various kinds of job activities (Mecham and McCormick, 1969).

A basic prerequisite of such a possible approach would consist of some systematic procedure for identifying and possibly quantifying job characteristics that might serve as common denominators for determining the similarities, and differences, between and among jobs. This is essentially a job analysis process. In this regard, a review of the literature relating to job analysis points out a few attempts to develop a "trait" type of approach to the analysis of jobs, or, in other words, attempts to characterize jobs in terms of the traits or human qualities required for successful job performance. One of the earliest such attempts was made by Viteles (1922, 1932) in his development of the Job Psychograph. Following from this is the work of the United States Training and Employment Service in the development of the Worker Characteristics Form (Stead and Shartle, 1940). In addition, the work of Jaspen (1949), Trattner, Fine, and Kubis (1955), and McCormick, Finn, and Scheips (1957) have added knowledge to this area.

Other systematic job analysis approaches have been directed more toward the analyses of jobs in terms of job activities and job-related behaviors. The J-coefficient, in part, is an example of such an approach (Primoff, 1955; Wherry, 1955).

Of central interest to this study is the work in this area that has been carried out by McCormick and his students in their development of a worker oriented approach to the analysis of jobs, reflected in the development, in sequence, of the Check List of Worker Activities, the Worker Activity Profile, and more recently the Position Analysis Questionnaire (PAQ). For a detailed description of this line of work, and of these various instruments, see Gordon (1963); Mecham (1968); and McCormick, Jeanneret, and Mecham (1969).

The present investigation is one phase of a research program that is, in part, directed toward the refinement of a procedure for establishing job requirements on the basis of synthetic or generalized validity. In this research one of the general approaches which has been tried is that in which experimental sets of job requirements for any given job are "built-up" for the job on the basis of data on the estimates of the attribute requirements of the individual job elements of a structured job analysis instrument, the Position Analysis Questionnaire (PAQ). The basic steps followed in such a procedure are (Mecham and McCormick, 1969):

1. The identification of the human "attributes" that are most relevant for personnel selection.

2. The rating, for each job element of the PAQ, of the degree to which each attribute is relevant to each job element.

3. The computation of an index of central tendency (i.e., the mean or median) of several ratings of each attribute (as to its relevance to each of the job elements of the PAQ), and the subsequent derivation of an attribute profile for each job element (this consisting of the mean or median attribute ratings for all attributes).

4. The analysis of a given job with the PAQ.

5. The computation, for each job, of a composite job attribute profile based on some summation or "building-up" of the attribute profiles of the job elements that are part of the job.

Purpose and Scope of the Present Study

The present study was primarily directed at obtaining estimates of the human attribute requirements for each of the various job elements of Form B of the PAQ. Similar data have been collected with respect to Form A of the PAQ (Mecham and McCormick, 1969), but the changes in the instrument which resulted in Form B render the earlier data incomplete with respect to Form B, thus necessitating the obtaining of data on the new job elements in order to complete the data set. In addition, an inspection of the taxonomy of attributes used previously, when compared to recent work in the area of the development of taxonomies of human abilities, pointed out that the previous list should be enlarged for the present study.

The data obtained were also viewed in terms of their possible utility in exploring the reliability of the ratings obtained as a function of the number of raters. There is evidence in the literature that the number of raters needed for a given purpose is dependent upon the situation, and upon the raters themselves (e.g., Christal, Madden, and Harding, 1960; Ghiselli, 1964), and, therefore, it was thought that the rating data obtained in this study might be useful in providing additional empirical data relating to the pooled reliability of ratings of various numbers of raters.

PROCEDURE

The determination of what data were relevant for collection, and the choice of the method of collecting these data, were in part implied by the previous work of Mecham (1968) and Mecham and McCormick (1969), and by the differences between Form A and Form B of the PAQ. A short explanation of these considerations will, therefore, be given at this point.

The critical difference between the two forms of the PAQ, insofar as this study was concerned, is that Form B contains 13 job elements which were not present in Form A, and an additional 9 job elements which were substantially modified from Form A. Minor modifications of job elements were not considered to be important enough to warrant further investigation. In order to obtain a complete set of ratings for all the job elements of Form B of the PAQ for the 68 attributes used previously by Mecham and McCormick, one of two approaches would be necessary: (1) obtain new ratings for all of the 68 attributes across all of the job elements of Form B of the PAQ; or, (2) use the earlier data and add to it ratings of the 68 attributes for the 22 new (or revised) job elements. The latter approach was followed in this study due to the practical consideration of obtaining the larger number of raters that would have been necessary to obtain completely new ratings for all of the attributes across all of the job elements of Form B of the PAQ. The details of this methodology may be found in Marquardt (1972), and so will not be repeated here.

Selection of New Attributes

It was considered desirable that a list of human attributes for experimental purposes such as those in this study should be as comprehensive as possible. For this reason, the existing list of 68 attributes was reviewed in an attempt to discover any gaps that might exist. The most comprehensive recent research relating to the nature of human abilities is that carried out by Fleishman and his associates at the American Institutes for Research (Theologus et. al., 1970). The resulting taxonomy consists of 37 human abilities. An examination of this list pointed out that 8 of the abilities were not among those on the existing list of 68 attributes. These 8 attributes were included in the present study, and ratings of their relevance to the job elements of the PAQ were obtained, in addition to obtaining ratings of the 68 "old" attributes for the 22 new job elements. (See Appendix A for a list of the 68 "old" attributes, and Appendix B for a list of the 8 "new" attributes.)

Selection of Raters

The raters in this study were largely drawn from among members of the Division of Industrial and Organizational Psychology (Division 14) of the American Psychological Association, who were solicited for their cooperation in this endeavor. The two considerations which guided the choice of Division 14 members as the population from which to draw the raters for this study were as follows: (1) this is the same population as that from which Mecham drew his raters, and the combination of ratings of the new job elements with Mecham's ratings would probably be more valid if this were also the population from which the raters for this study were drawn; and, (2) the rating task which the raters were asked to perform was a relatively difficult one, and it was felt that this population of raters would most easily and accurately understand what was desired of them, and make their ratings accordingly. Materials were sent to a total of 97 raters, and returned by 80 raters.

Rating Procedures

Each rater was sent a package of materials which included a set of instructions for the rating task, Attribute Rating Forms on which to record his ratings, and a copy of Form B of the PAQ. The raters were divided into two groups. One group of 45 rated the "old" attributes (those included in the original list of 68) as they related to the 22 new job elements of Form B of the PAQ; each such rater rated 12 attributes as related to those job elements. The remaining 35 raters were asked to rate two of the "new" attributes as they related to the job elements of the PAQ that were used in this process. Twelve of the 194 job elements were not used because they were of a "write-in" nature, or otherwise did not lend themselves to such rating.

In general, the rater was asked to rate the relevance (or importance) of each of the assigned attributes to each job element using a 6-point scale which ranged from no relevance to extreme relevance[1].

Statistical Procedures

In order to derive pooled estimates of the judged attribute requirements of the job elements of the PAQ, the mean attribute ratings across raters were determined for each PAQ job element and attribute. An inspection of the distributions of the ratings showed that a few were badly skewed, and suggested that in those cases the mean ratings might not be as appropriate

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[1] The following format was suggested as an aid for use in making the ratings: "(The given attribute) is of (degree) relevance in, or in dealing with, (the specific PAQ job element)." In addition, the frame of reference, or conceptual format, suggested was for the rater to consider a hypothetical job in which the highest level of the PAQ job element applied, and then rate the attribute as it would be relevant to that aspect of the job represented by the particular PAQ job element. "Highest level" in this context refers to the scales provided in the PAQ which are used when analyzing a job with the PAQ, and, in particular, to the highest value or top of each of these scales. For a more detailed explanation of these procedures, see Marquardt (1972).

a measure of central tendency as the median. Although such skewed distributions were rare in the data, it was felt that in these few cases the median might be a more appropriate index to use, considering the future use of the data derived from this study. In so far as the means derived from positively skewed distributions might be viewed as overestimates of the attribute requirements, they would make an attribute appear to be more relevant to a job element (and thus to a job after job analysis) than would in fact be the case, and might thus result in the establishment of excessively high personnel specifications. For this reason, the median relevance ratings were computed. These were derived for each job element and attribute using the following decision rules:

1. When an even number of rank-ordered ratings were considered, and when the two ratings in the middle of the sequence were different, the midpoint between the two was taken as the median.

2. When an odd number of ratings were considered, the middle rating of the rank-order sequence was taken as the median.

3. When the median exceeded the mean by .50 or more, sufficient variability was assumed to be present to warrant the adjusting of the median downward by .50.

4. When the median and mean were equal, within .49 of each other, or when the mean exceeded the median, the median value as computed was accepted.

In those cases where the distributions of ratings were symmetrical, this procedure essentially resulted in equal means and medians, and when the distributions were positively skewed the procedure resulted in the acceptance of the median as computed. When the distributions were negatively skewed, however, the median would exceed the mean when only decision rules 1 and 2 are considered. Decision rule 3 was included to make the final median more conservative (i.e., lower) when the distributions of the ratings were negatively skewed. The rationale for this procedure was again a consideration of the possible future use of the data, and the implications drawn from them. (As an aside, however, the Pearson produce-moment correlation between the means and medians was computed. This correlation was .97, indicating that the two values had an extremely high degree of correspondence, despite the few skewed distributions.)

In order to determine the stability of the attribute ratings, the inter-rater reliability for each attribute was computed using the ANOVA approach suggested by Winer (1971, Sec. 4.5). These computations were made using the mean ratings, as the medians are essentially a dead-end statistic, and the means are easier to deal with statistically than are the medians. The coefficient computed was the intra-class correlation coefficient, and the computations were made using a formula found in Winer (1971, p. 290). This formula corrects for the differing frames of reference of the various raters, as such frames of reference should not be considered a part of the error of measurement when computing a reliability coefficient. (It should be noted here that all of the reliability computations in this study were made using the unbiased estimates rather than the biased ones.) Finally, the Spearman-Brown prediction formula estimates of the reliability coefficient

for the n raters for a given attribute were computed using the intra-class correlation coefficient as a starting point for the step-up.

The reliability analyses conducted in this study were made on what may be termed the "combined" data, that is, the combination of Mecham and McCormick's data with the new data collected in this study. Since the data collected for the 68 "old" attributes was for only the 22 new job elements, and because these data essentially fit the "holes" in Mecham and McCormick's data, each of their raters for a given attribute was paired with one of the new raters, and the data combined by "filling the holes." This procedure resulted in a set of ratings for a given rater which are complete with respect to the job elements of Form B of the PAQ.

The last analyses performed dealt with the pooled rel . of varying numbers of raters in providing estimates of job-re data such as those obtained in this study. These analyses consisted of: (1) drawing a subsample of a few attributes; (2) for each of these attributes drawing successive multiple subsamples of a given n (for example, multiple samples of 2 raters, 3 raters, 4 raters, etc.); and (3) computing the reliability of each of these subsamples. The resulting multiple reliability estimates for any given n were then averaged and used in conjunction with the Spearman-Brown formula to estimate the reliability at a higher n. This was essentially a comparison of the empirically derived values with estimates based on the Spearman-Brown formula to determine the degree of correspondence. After this, the Spearman-Brown step-ups of the intra-class correlation coefficients derived from the total sample of raters for each of the attributes were determined for values of n ranging from 2 raters through 20 raters. These data were then plotted[2].

RESULTS

As explained above, the median attribute rating for each attribute and job element was computed as an index of the attribute requirement of the job element. The complete matrix of these medians may be found in Appendix C. The table of means may be found in Marquardt (1972). As indi d before, however, the Pearson product-moment correlation between the m as and medians across all attributes and job elements was computed, and found to be .97. Table 1 reflects the nature of these data, and contains

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[2]Although the determination of the sample size needed to obtain adequate reliability was made in this fashion, the possibility of making this determination by means of the power function charts for ANOVA main effects was also considered. Intuitively, this determination could be made using power functions, as the ANOVA approach to determining reliability essentially results in a test of the main effect of differences between ratings, and the amount of variance accounted for by this effect. However, in this situation the number of treatment levels (items) is 180, and the highest value of k (number of treatment levels) available from the power charts is k=8. Thus, the power charts are of little value in this particular situation, and the approach described was used. This approach is, however, the conventional way in which the number of raters needed to obtain a certain reliability of the ratings is determined.

a sample of the means and medians of three attributes for ten job elements. These values may be interpreted using the following 6-point scale, which was also the scale on which the raters made their ratings:

Code	Degree of relevance of attribute to job element of PAQ
0	Attribute is of no relevance to job element
1	Very limited or nominal relevance
	[illegible]ited relevance
	[illegible]erate relevance
4	Substantial or considerable relevance
5	Extreme or extensive relevance

Table 1

Mean and Median Ratings of Attribute Requirements
for Three Illustrative Attributes for a Sample of PAQ Job Elements

		Attribute					
		(1) Verbal comprehension		(42) Variety of duties		(69) Ideational fluency	
	PAQ elements	Mean	Median	Mean	Median	Mean	Median
1.	Written materials	4.7	5.0	3.1	3.0	0.8	0.0
36.	Decision making	4.5	5.0	3.8	4.0	3.2	3.5
58.	Measuring devices	1.2	1.0	1.8	2.0	0.4	0.0
81.	Assembling/disassembling	0.5	0.0	1.9	2.0	0.9	0.5
93.	Finger manipulation	0.5	0.0	2.0	2.0	0.7	0.0
108.	Signaling	2.5	3.0	1.8	2.0	1.2	0.5
133.	Staff functions	4.4	4.0	4.0	4.0	3.9	4.0
148.	Civic obligations	2.9	3.0	2.5	2.5	2.8	3.0
170.	Repetitive activities	0.6	0.0	1.9	1.5	0.4	0.0
174.	Precision	1.4	1.0	2.1	1.5	0.7	0.0

Table 2 reflects the number of raters who rated each given attribute, and the reliability coefficient for each of these attributes. These coefficients were computed across 180 of the 194 job elements of Form B of the PAQ, because job elements 188 through 194 deal with pay/income, and no data were collected for them; and job elements 44, 60, 127, 160, and 181 were eliminated from consideration as they are open ended in nature and any sort of response is possible. (Job elements 143 and 176 were also omitted as data for these two job elements were collected separately.)

Table 2

Coefficients of Reliability of Ratings of
Attribute Requirements of 180 Job Elements of the PAQ

Attribute number	Attribute	No. of raters ("N")*	Intraclass correlation coefficient	Coefficient for ("N") raters**
1.	Verbal comprehension	11	.709	.964
2.	Word fluency	9	.635	.940
3.	Oral communication	10	.705	.960
4.	Numerical computation	10	.524	.917
5.	Arithmetic reasoning	9	.511	.904
6.	Convergent thinking	10	.409	.874
7.	Divergent thinking	10	.497	.908
8.	Intelligence	10	.618	.942
9.	Long-term memory	10	.468	.898
10.	Short-term memory	10	.370	.855
11.	Aesthetic judgment	9	.333	.818
12.	Visual form perception	9	.649	.943
13.	Perceptual speed	10	.413	.875
14.	Closure	10	.399	.869
15.	Movement detection	10	.426	.881
16.	Spatial visualization	10	.475	.900
17.	Near visual acuity	10	.517	.914
18.	Far visual acuity	10	.527	.918
19.	Depth perception	10	.569	.929
20.	Color discrimination	10	.471	.899
21.	Auditory acuity	9	.580	.926
22.	Olfactory acuity	11	.520	.923
23.	Gustatory acuity	11	.378	.870
24.	Tactual acuity	10	.602	.938
25.	Body orientation	10	.361	.849
26.	Kinesthesis	10	.694	.958
27.	Finger dexterity	10	.571	.930
28.	Manual dexterity	10	.593	.936
29.	Arm/hand positioning	10	.647	.948
30.	Arm/hand steadiness	10	.552	.925
31.	Continuous muscular control	10	.563	.928
32.	Rate of arm movement	9	.603	.932
33.	Eye-hand coordination	11	.596	.942
34.	Eye-hand-foot coordination	11	.497	.916
35.	Simple reaction time	9	.303	.796
36.	Response integration	9	.521	.907
37.	Dynamic strength	10	.609	.940
38.	Static strength	11	.628	.949
39.	Explosive strength	10	.358	.848
40.	Rate control	10	.397	.868

*This number refers to the number of raters in the combined data
**Computed from the intra-class correlation coefficient with the Spearman-Brown prediction formula

Table 2 (continued)

Attribute number	Attribute	No. of raters ("N")*	Intraclass correlation coefficient	Coefficient for ("N") raters**
41.	Mechanical ability	10	.338	.836
42.	Variety of duties	8	.211	.682
43.	Repetitive/short-cycle operations	8	.404	.844
44.	Dealing with things/objects	8	.434	.860
45.	Processes/machines/techniques	8	.430	.858
46.	Scientific/technical activities	8	.346	.809
47.	Dealing with people	9	.729	.960
48.	Social welfare	8	.409	.847
49.	Influencing people	8	.695	.948
50.	Directing/controlling/planning	8	.476	.879
51.	Empathy	8	.666	.941
52.	Personal risk	8	.528	.900
53.	Conflicting/ambiguous information	8	.537	.903
54.	Pressure of time	8	.292	.767
55.	Sensory alertness	8	.294	.769
56.	Attainment of set standards	8	.450	.867
57.	Working under specific instructions	8	.317	.788
58.	Working alone	9	.005	.043
59.	Separation from family/home	8	.266	.744
60.	Stage presence	8	.536	.902
61.	Prestige/esteem from others	8	.513	.894
62.	Tangible/physical end-products	9	.331	.816
63.	Sensory/judgmental criteria	8	.412	.849
64.	Measurable/verifiable criteria	8	.204	.672
65.	Interpretation from personal viewpoint	8	.359	.817
66.	Susceptibility to fatigue	8	.295	.770
67.	Dealing with concepts/ information	9	.587	.928
68.	Creative activities	8	.229	.703
69.	Ideational fluency	10	.487	.905
70.	Originality	9	.414	.864
71.	Problem sensitivity	9	.450	.880
72.	Spatial orientation	8	.478	.880
73.	Selective attention	9	.540	.914
74.	Time sharing	9	.510	.904
75.	Stamina	8	.528	.900
76.	Speed of limb movement	8	.699	.949

*This number refers to the number of raters in the combined data

**Computed from the intra-class correlation coefficient with the Spearman-Brown prediction formula

Each of the intra-class correlation coefficients reported in Table 2 may be interpreted as the reliability of a single hypothetical rating, computed from data adjusted for the frame of reference of the raters, and is approximately equal to the average intercorrelation between ratings given by all possible pairs of raters. Since this statistic only reflects the reliability of a single rating, and since the reliability coefficients of interest here are those for the means of all raters, the Spearman-Brown prediction formula values of the reliability coefficients for the actual number of raters for each attribute are also given in Table 2. Each of these coefficients may be interpreted as the reliability of the mean attribute ratings across all raters for a given attribute. It might be mentioned here, however, that the actual correlation coefficient (rather than the Spearman-Brown step-ups) was also computed for each attribute for the total sample of raters, and it was found that these values were actually the same as those given by the Spearman-Brown formula.

Table 3 reflects the number of attributes which have intra-class correlation coefficients falling into given intervals of .05 starting at an initial value of .20, and going through a value of .75. From this table, it may be seen that the majority of the attributes have coefficients greater than .25. Figure 1 shows the graphs of the Spearman-Brown estimates for increasing numbers of raters, as computed using intra-class correlation coefficients ranging from .20 through .75 in steps of .05 as starting values, and numbers of raters ranging from 2 through 20. As is evident from Table 3, these values represent the range of those found empirically in this study for the combined data. It was decided to use

Table 3

Frequency Distribution of the Intra-class Correlation Coefficients for the Combined Data

Value of intra-class correlation coefficient	Number of attributes falling in interval
Less than .19	1
.20-.25	3
.26-.30	5
.31-.35	5
.36-.40	8
.41-.45	10
.46-.50	8
.51-.55	14
.56-.60	9
.61-.65	6
.66-.70	4
.71-.75	3

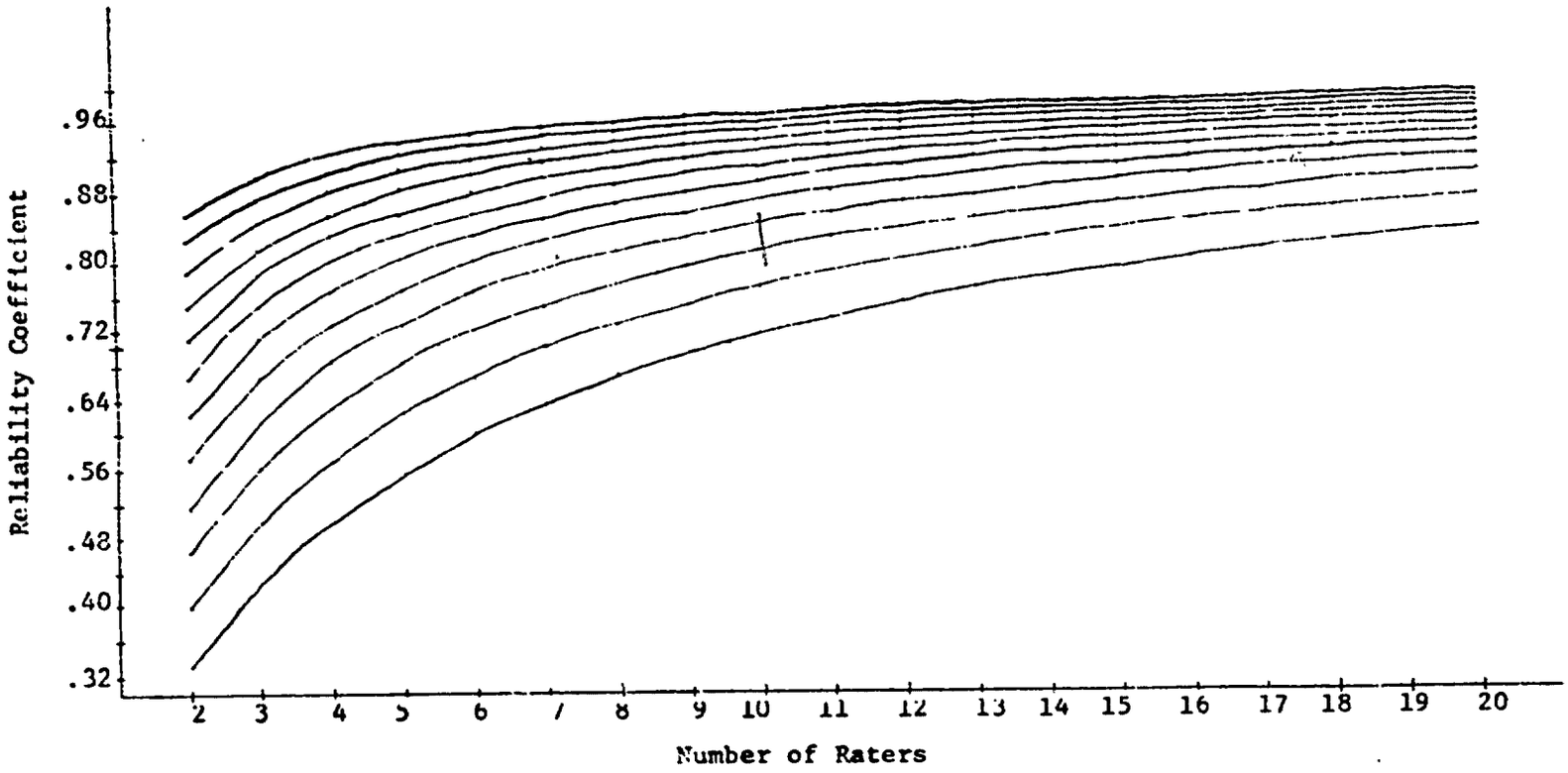

Figure 1. Coefficients of Reliability of Ratings as a Function of the Number of Raters

Note: Values indicated at left of curves represent initial intra-class coefficients

these values when plotting the graphs, rather than those derived empirically, as the data and graphs resulting from such values are equivalent to those which would be found using the empirical data, and result in the same conclusions. It may be seen from Figure 1 that the curves seem to be levelling off somewhat in the range of 8 to 10 raters.

DISCUSSION AND CONCLUSIONS

As is evident from the attribute profiles resulting from this study (Appendix C), job activities related to the various job elements of the PAQ appear to depend upon a wide range of human qualities. The reliability coefficients obtained for the ratings upon which the profiles are based were rather respectable, generally ranging from .80 to the upper .90's, and give an indication of the stability of the means and medians which were computed.

In reviewing the pattern presented by the reliability coefficients, it becomes evident that the attributes of an "aptitude" nature were rated more reliably than those of an "interest or temperament" nature. Such a finding is consistent with that of prior research, and is, in part, explainable by looking more closely at the actual attributes which were used. The attributes which were of an aptitude nature were generally those which are commonly referred to in a personnel setting as human abilities, and, therefore, those with which the raters in this study might be expected to be most familiar. The attributes which were of an interest or temperament nature, on the other hand, were generally those which presumably are relevant more to the personal interest in, and personal adjustment to, the various job activities and situations depicted by the job elements, than to the overt behavioral aspects of the elements as such. Thus, their relevance to the job elements might actually be of less consequence than that of the "aptitudes." Such less obvious direct relevance of the interest and temperament attributes to the job elements, in turn, may have contributed to the somewhat lower reliability of the ratings of them--as contrasted to that of the aptitudes. Some written comments received from the raters would seem to support this hypothesis, as the raters in general seemed to have more trouble rating the temperament attributes than they did the aptitude attributes.

In so far as the data concerning the step-up in reliability as a function of the number of raters is concerned, the data would seem to indicate that if future studies are concerned with the reliability of ratings of job-related variables, the researchers would usually be wise to obtain samples of raters ranging in size from 8 to 10. The desired degree of reliability and the use which is to be made of the data must, of course, be taken into account when the number of raters is determined, but, in general terms, fewer than 8 raters would most likely result in data of questionable reliability, and more than 10 raters would most likely be a waste of time and effort when judged in relation to the negligible return in increased reliability balanced against the increased costs in terms of time and money. This recommendation is, however, tempered by a consideration of the population from which the raters are to be drawn, the familiarity of raters from this population with the concepts being rated, and the number of items to be rated.

In general, the following conclusions appear to be warranted on the basis of the results of the investigation:

1. Raters are able to rate the relevance of human attributes to the job elements in a structured job analysis instrument such as the PAQ, and do so with respectable reliability (the reliability coefficients of the pooled ratings generally ranged from .80 to the upper .90's).

2. A large number of human attributes appear to be relevant to one or more of the job elements of the PAQ, with some attributes being relevant to more job elements than others.

In turn, it would seem that these conclusions might suggest the following implications:

1. The attribute profiles of the job elements of the PAQ would seem to be of potential use as the basis for determining the attribute requirements of jobs, through job analysis of jobs with the PAQ.

2. In turn, such profiles might be of use in the establishment of the synthetic validity of tests for use in personnel programs in industry.

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APPENDIX A

LIST OF ATTRIBUTES DEVELOPED BY MECHAM

Attributes of an "aptitude" nature

1. Verbal comprehension: ability to understand the meaning of words and the ideas associated with them.

2. Word fluency: ability to rapidly produce words associated with a given word.

3. Oral communication: ability to communicate ideas with gestures or with spoken or written words.

4. Numerical computation: ability to manipulate quantative symbols rapidly and accurately, as in various arithmetic operations.

5. Arithmetic reasoning: ability to reason abstractly using quantitative concepts and symbols.

6. Convergent thinking: ability to select from possible alternative methods, the method of processing information that leads to the potentially best answer or solution to a problem.

7. Divergent thinking: ability to generate or conceive of new or innovative ideas or solutions to a problem.

8. Intelligence: the level of abstraction or symbolic complexity with which one can ultimately deal.

9. Long-term memory: ability to learn and store pertinent information and selectively to retrieve or recall, much later in time, that which is relevant to a specific context.

10. Short-term memory: ability to learn and store pertinent information and selectively to retrieve or recall, within a brief period of time, that which is relevant to a specific context.

11. Aesthetic judgement: ability to make sensitive evaluations of artistic quality in one or more of the following: music, style, painting, sculpture, photography, architecture, etc.

12. Visual form perception: ability to perceive pertinent detail or configuration in a complex visual stimulus.

13. Perceptual speed: ability to make rapid discriminations of visual detail.

14. Closure: ability to perceptually organize a chaotic or disorganized field into a single perception.

15. Movement detection: ability to detect physical movement of objects and to judge their direction.

16. Spatial visualization: ability to manipulate visual images in two or three dimensions mentally.

17. Near visual acuity: ability to perceive detail at normal reading distance.

18. Far visual acuity: ability to perceive detail at distances beyond normal reading distance.

19. Depth perception: ability to estimate depth of distances or objects (or to judge their physical relationships in space).

20. Color discrimination: ability to perceive similiarities or differences in colors or in shades of the same color, or to identify certain colors.

21. Auditory acuity: ability to perceive relevant cues by sound.

22. Olfactory acuity: ability to perceive relevant cues by smell.

23. Gustatory acuity: ability to perceive relevant cues by taste.

24. Tactual acuity: ability to perceive relevant cues by touch.

25. Body orientation: ability to maintain body orientation with respect to balance and motion.

26. Kinesthesis: ability to sense position and movement of body members.

27. Finger dexterity: ability to manipulate small objects (with the fingers) rapidly and accurately.

28. Manual dexterity: ability to manipulate things with the hands.

29. Arm/hand positioning: ability to make precise, accurate movements of the hands and arms.

30. Arm/hand steadiness: ability to keep the hands and arms immobilized in a set position with minimal tremor.

31. Continuous muscular control: ability to exert continuous control over external devices through continual use of body limbs.

32. Rate of arm movement: ability to make gross, rapid arm movements.

33. Eye-hand coordination: ability to coordinate hand movements with visual stimuli.

34. Eye-hand-foot coordination: ability to move the hand and foot coordinately with each other in accordance with visual stimuli.

35. Simple reaction time: the period of time elapsing between the appearance of any stimulus and the initiation of an appropriate response.

36. Response integration: ability to rapidly perform various appropriate psychomotor responses in proper sequence.

37. Dynamic strength: ability to make repeated, rapid, flexing movements in which the rapid recovery from muscle strain is critical.

38. Static strength: ability to maintain a high level of muscular exertion for some minimum period of time.

39. Explosive strength: ability to expend a maximum amount of energy in one or a series of explosive or ballistic acts (as in throwing, pounding, etc.)

40. Rate control: ability to make continuous anticipatory motor adjustments, relative to change in speed and direction of continuous moving objects.

41. Mechanical ability: ability to determine the functional interrelationships of parts within a mechanical system.

Attributes of an interest or temperament nature, as characterized by different types of job situations to which people must adjust.

42. Variety of duties: duties often characterized by frequent change.

43. Repetitive/short-cycle operations: operations carried out according to set procedures or sequences.

44. Dealing with things/objects: preference for situations involving activities which deal with things and objects rather than activities concerned with people or the communication of ideas.

45. Processes/machines/techniques: situations which are nonsocial in nature, being primarily concerned with methods and procedures often of a mechanical or chemical nature.

46. Scientific/technical activities: using technical methods or investigating natural phenomenon using scientific procedures.

47. Dealing with people: i.e., personal contacts beyond giving and receiving instructions.

48. Social welfare: working with people for their presumed good.

49. Influencing people: influencing opinions, attitudes, or judgements about ideas or things.

50. Directing/controlling/planning: operations involving the activities of others, or processes with which others are involved.

51. Empathy: seeing things from another person's point of view.

52. Personal risk: risk of physical or mental illness or injury.

53. Conflicting/ambiguous information: ability to tolerate and critically evaluate information of an uncertain or opposing nature.

54. Pressure of time: working in situations where time is a critical factor for successful job performance.

55. Sensory alertness: alertness over extended periods of time.

56. Attainment of set standards: attainment of set limits, tolerances, or standards.

57. Working under specific instructions: i.e., those that allow little or no room for independent action or judgement in working out job problems.

58. Working alone: working in physical isolation from others, although the activity may be integrated with that of others.

59. Separation from family/home: separation for extended periods of time.

60. Stage presence: speaking to or performing for an audience.

61. Prestige/esteem from others: working in situations resulting in high regard from others.

62. Tangible/physical end-products: working with material elements or parts which ultimately result in a physical product.

63. Sensory/judgmental criteria: arriving at generalizations, judgments, or decisions which require sensory discrimination or cognitive appraisal.

64. Measurable/verifiable criteria: arriving at generalizations, judgments, or decisions based on known or obtainable standards, characteristics, or dimensions.

65. Interpretation from personal viewpoint: interpretation of feelings, ideas, or facts in terms of personal viewpoint or values.

66. Susceptibility to fatigue: diminished ability to do work, either physical or mental, as a consequence of previous and recent work done.

67. Dealing with concepts/information: preference for situations that involve conceptual or informative ideas and the possible communication of these ideas to others.

68. Creative activities: preference for situations involving the finding of new solutions to a problem or new modes of artistic expression.

APPENDIX B

LIST OF NEW ATTRIBUTES

New attributes of an "aptitude" nature

1. Ideational fluency: the ability to produce a number of ideas concerning a given topic. This attribute is only concerned with the number of ideas produced and does not extend to the quality of those ideas.

2. Originality: the ability to produce unusual or clever responses related to a given topic or situation. This attribute is concerned with the degree of creativity of responses and does not deal with the number of responses made.

3. Problem sensitivity: the ability to recognize or identify the existence of problems. This attribute does not include any of the reasoning necessary for the solution of a problem.

4. Spatial orientation: the ability to maintain one's orientation with respect to objects in space or to comprehend the position of objects in space with respect to the observer's position.

5. Selective attention: the ability to perform a task in the presence of distracting stimulation or under monotonous conditions without significant loss in efficiency.

6. Time sharing: the ability to utilize information obtained by shifting between two or more channels of information. The information obtained from these sources is either integrated and used as a whole or retained and used separately.

7. Stamina: this ability involves the capacity to maintain physical activity over prolonged periods of time. It is concerned with the resistance of the cardio-vascular system to breakdown.

8. Speed of limb movement: this ability involves the speed with which discrete movements of the arms or legs can be made. The ability deals with the speed with which the movement can be carried out after it has been initiated; it is not concerned with the speed of initiation of the movement.

APPENDIX C: MEDIAN ATTRIBUTE RATINGS FOR JOB ELEMENTS OF THE POSITION ANALYSIS QUESTIONNAIRE (PAQ)

MEDIAN ATTRIBUTE RATINGS FOR JOB [ELEMENTS]

OF THE POSITION ANALYSIS QUESTIONNA[IRE]

Attributes

Verbal Comprehension, Word Fluency, Oral Communication, Numerical Computation, Arithmetic Reasoning, Convergent Thinking, Divergent Thinking, Intelligence, Long-term Memory, Short-term Memory, Aesthetic Judgment, Visual Form Perception, Perceptual Speed, Closure, Movement Detection, Spatial Visualization, Near Visual Acuity, Far Visual Acuity, Depth Perception, Color Discrimination, Auditory Acuity, Olfactory Acuity, Gustatory Acuity, Tactual Acuity, Body Orientation, Kinesthesis, Finger Dexterity, Manual Dexterity, Arm/Hand Positioning, Arm/Hand Steadiness, Continuous Muscular Control, Rate of Arm Movement, Eye-Hand Coordination, Eye-Hand-Foot Coordination, [remaining attribute headings cut off or illegible]

Job Elements

Section	Job Element	Ratings
Information Input	1 Written materials	[illegible]
	2 Quantitative materials	[illegible]
	3 Pictorial materials	[illegible]
	4 Patterns/related devices	[illegible]
	5 Visual displays	[illegible]
	6 Measuring devices	[illegible]
	7 Mechanical devices	[illegible]
	8 Materials in process	[illegible]
	9 Materials not in process	[illegible]
	10 Features of nature	[illegible]
	11 Man-made environment	[illegible]
	12 Behavior	[illegible]
	13 Events or circumstances	[illegible]
	14 Art or decor	[illegible]
	15 Verbal sources	[illegible]
	16 Non-verbal sounds	[illegible]
	17 Touch	[illegible]
	18 Odor	[illegible]
	19 Taste	[illegible]
	20 Near visual differentiation	[illegible]
	21 Far visual differentiation	[illegible]
	22 Depth perception	[illegible]
	23 Color perception	[illegible]
	24 Sound pattern recognition	[illegible]
	25 Sound differentiation	[illegible]
	26 Body movement sensing	[illegible]
	27 Body balance	[illegible]
	28 Estimating speed mov parts	[illegible]
	29 Estimating speed mov obj.	[illegible]
	30 Estimating speed processes	[illegible]
	31 Judging condition/quality	[illegible]
	32 Inspecting	[illegible]
	33 Estimating quantity	[illegible]
	34 Estimating size	[illegible]
	35 Estimating time	[illegible]
Mental Processes	36 Decision making	[illegible]
	37 Reasoning in problem solving	[illegible]
	38 Amount of planning/scheduling	[illegible]
	39 Combining information	[illegible]
	40 Analyzing information	[illegible]
	41 Compiling	[illegible]
	42 Coding/decoding	[illegible]
	43 Transcribing	[illegible]
	45 Short-term memory	[illegible]
	46 Education	[illegible]
	47 Job-related experience	[illegible]
	48 Training	[illegible]
	49 Using mathematics	[illegible]
Work Output	50 Man powered precision tools	[illegible]
	51 Man powered non-prec tools	[illegible]
	52 Long-handle tools	[illegible]
	53 Handling devices/tools	[illegible]
	54 Powered precision tools	[illegible]
	55 Powered non-precision tools	[illegible]
	56 Drawing/related devices	[illegible]
	57 Applicators	[illegible]
	58 Measuring devices	[illegible]
	59 Technical/related devices	[illegible]
	61 Machines/equipment	[illegible]
	62 Activation controls	[illegible]
	63 Fixed setting controls	[illegible]
	64 Variable setting controls	[illegible]
	65 Keyboard devices	[illegible]
	66 Frequent adj hand controls	[illegible]
	67 Freq adjusted foot controls	[illegible]
	68 Continuous hand controls	[illegible]
	69 Continuous foot controls	[illegible]
	70 Man-powered vehicles	[illegible]
	71 Powered highway/rail vehicles	[illegible]
	72 Powered mobile equipment	[illegible]
	73 Powered water vehicles	[illegible]
	74 Air/space vehicles	[illegible]
	75 Man-moved mobile equipment	[illegible]
	76 Operating equipment	[illegible]
	77 Remote-controlled equipment	[illegible]
	78 Setting up/adjusting	[illegible]
	79 Manually modifying	[illegible]
	80 Material-controlling	[illegible]
	81 Assembling/disassembling	[illegible]
	82 Arranging/positioning	[illegible]
	83 Feeding/off-bearing	[illegible]
	84 Physical handling	[illegible]
	85 Highly skilled body coord	[illegible]
	86 Balancing	[illegible]
	87 Level of physical exertion	[illegible]
	88 Sitting	[illegible]
	89 Standing	[illegible]
	90 Walking/running	[illegible]
	91 Climbing	[illegible]
	92 Kneeling/stooping	[illegible]
	93 Finger manipulation	[illegible]
	94 Hand-arm manipulation	[illegible]
	95 Hand-arm steadiness	[illegible]
	96 Eye-hand/foot coordination	[illegible]
	97 Limb move. no visual control	[illegible]
	98 Hand-ear coordination	[illegible]
[Relationshi]ps with Other Persons	99 Advising	[illegible]
	100 Negotiating	[illegible]
	101 Persuading	[illegible]
	102 Instructing	[illegible]
	103 Interviewing	[illegible]
	104 Routine information exchange	[illegible]
	105 Non-routine info exchange	[illegible]
	106 Public speaking	[illegible]
	107 Writing	[illegible]
	108 Signaling	[illegible]
	109 Code communi[cat]ions	[illegible]
	110 Entertaining	[illegible]
	111 Serving/catering	[illegible]
	112 Job-required personal contact	[illegible]
	113 Executives/officials	[illegible]
	114 Middle management/staff	[illegible]
	115 Supervisors	[illegible]
	116 Professional personnel	[illegible]
	117 Semi-professional personnel	[illegible]
	118 Clerical personnel	[illegible]
	119 Manual and service workers	[illegible]
	Sales personnel	[illegible]
	Buyers	[illegible]
	Public customers	[illegible]
	The public	[illegible]
	Students/trainees/apprentices	[illegible]
	125 Clients/patients/counselees	[illegible]
	126 Special interest groups	[illegible]
	[illegible]	[illegible]

	29	[illegible]	1.0 0.0 0.0 2.0 1.0	2.0 1.0 2.0 2.5 2.0	[illegible]
	30	Estimating speed processes	1.0 0.0 0.0 2.0 3.0	2.0 1.0 3.0 3.0 3.0	[illegible]
	31	Judging condition/quality	1.5 1.0 0.0 2.0 2.0	3.5 2.0 4.0 4.0 2.0	[illegible]
	32	Inspecting	1.5 0.0 0.0 1.0 2.0	2.5 1.0 3.5 3.0 3.0	[illegible]
	33	Estimating quantity	1.0 0.0 0.0 3.0 3.5	2.5 1.0 3.0 3.0 3.0	[illegible]
	34	Estimating size	1.0 0.0 0.0 2.0 3.5	2.5 1.0 2.0 3.0 3.0	[illegible]
	35	Estimating time	2.0 0.0 .5 3.5 3.5	1.5 1.0 3.0 3.5 3.0	[illegible]
Mental Processes	36	Decision making	5.0 3.5 3.5 3.0 3.0	5.0 4.0 5.0 5.0 4.0	[illegible]
Mental Processes	37	Reasoning in problem solving	5.0 4.0 3.5 3.0 4.5	5.0 5.0 5.0 5.0 4.0	[illegible]
Mental Processes	38	Amount of planning/scheduling	5.0 2.5 3.0 4.0 4.0	4.0 4.5 5.0 4.5 3.5	[illegible]
Mental Processes	39	Combining information	4.5 3.5 3.5 4.0 4.0	4.0 4.5 5.0 4.0 4.5	[illegible]
Mental Processes	40	Analyzing information	5.0 4.0 3.0 4.0 4.0	5.0 4.5 5.0 5.0 4.0	[illegible]
Mental Processes	41	Compiling	4.0 3.0 2.5 2.0 3.0	3.0 4.0 3.5 3.0 4.0	[illegible]
Mental Processes	42	Coding/decoding	4.5 4.0 3.0 3.5 3.0	3.0 3.0 4.0 4.5 4.5	[illegible]
Mental Processes	43	Transcribing	3.0 2.0 3.0 3.0 3.0	2.5 2.0 2.5 3.0 4.0	[illegible]
Mental Processes	45	Short-term memory	3.0 3.5 3.0 1.0 1.0	2.0 3.5 3.0 4.0 5.0	[illegible]
Mental Processes	46	Education	5.0 5.0 4.5 2.5 3.0	3.0 3.0 4.5 5.0 3.5	[illegible]
Mental Processes	47	Job-related experience	0.0 2.5 2.0 0.0 0.0	2.5 2.5 1.0 4.0 1.0	[illegible]
Mental Processes	48	Training	2.5 3.5 3.0 0.0 0.0	3.0 2.5 3.0 3.5 2.0	[illegible]
Mental Processes	49	Using mathematics	3.5 3.0 2.0 5.0 5.0	5.0 3.5 4.5 4.5 3.5	[illegible]
Work Output	50	Man powered precision tools	1.0 0.0 0.0 1.0 1.0	1.0 0.0 3.0 2.0 1.0	[illegible]
Work Output	51	Man powered non-prec tools	0.0 0.0 0.0 0.0 0.0	0.0 0.0 1.5 1.0 1.0	[illegible]
Work Output	52	Long-handle tools	0.0 0.0 0.0 0.0 0.0	0.0 0.0 1.0 1.0 1.0	[illegible]
Work Output	53	Handling devices/tools	0.0 0.0 0.0 0.0 0.0	0.0 0.0 1.0 1.0 1.0	[illegible]
Work Output	54	Powered precision tools	1.0 0.0 0.0 0.0 1.0	1.0 0.0 3.0 2.0 2.0	[illegible]
Work Output	55	Powered non-precision tools	0.0 0.0 0.0 0.0 1.0	0.0 0.0 2.0 1.0 1.0	[illegible]
Work Output	56	Drawing/related devices	[illegible]	[illegible]	[illegible]
Work Output	57	Applicators	[illegible]	[illegible]	[illegible]
Work Output	58	Measuring devices	[illegible]	[illegible]	[illegible]
Work Output	59	Technical/related devices	[illegible]	[illegible]	[illegible]
Work Output	61	Machines/equipment	[illegible]	[illegible]	[illegible]
Work Output	62	Activation controls	[illegible]	[illegible]	[illegible]
Work Output	63	Fixed setting controls	[illegible]	[illegible]	[illegible]
Work Output	64	Variable setting controls	[illegible]	[illegible]	[illegible]
Work Output	65	Keyboard devices	[illegible]	[illegible]	[illegible]
Work Output	66	Frequent adj hand controls	[illegible]	[illegible]	[illegible]
Work Output	67	Freq adjusted foot controls	[illegible]	[illegible]	[illegible]
Work Output	68	Continuous hand controls	[illegible]	[illegible]	[illegible]
Work Output	69	Continuous foot controls	[illegible]	[illegible]	[illegible]
Work Output	70	Man-powered vehicles	[illegible]	[illegible]	[illegible]
Work Output	71	Powered highway/rail vehicles	[illegible]	[illegible]	[illegible]
Work Output	72	Powered mobile equipment	[illegible]	[illegible]	[illegible]
Work Output	73	Powered water vehicles	[illegible]	[illegible]	[illegible]
Work Output	74	Air/space vehicles	[illegible]	[illegible]	[illegible]
Work Output	75	Man-moved mobile equipment	[illegible]	[illegible]	[illegible]
Work Output	76	Operating equipment	[illegible]	[illegible]	[illegible]
Work Output	77	Remote-controlled equipment	[illegible]	[illegible]	[illegible]
Work Output	78	Setting up/adjusting	[illegible]	[illegible]	[illegible]
Work Output	79	Manually modifying	[illegible]	[illegible]	[illegible]
Work Output	80	Material-controlling	[illegible]	[illegible]	[illegible]
Work Output	81	Assembling/disassembling	[illegible]	[illegible]	[illegible]
Work Output	82	Arranging/positioning	[illegible]	[illegible]	[illegible]
Work Output	83	Feeding/off-bearing	[illegible]	[illegible]	[illegible]
Work Output	84	Physical handling	[illegible]	[illegible]	[illegible]
Work Output	85	Highly skilled body coord	[illegible]	[illegible]	[illegible]
Work Output	86	Balancing	[illegible]	[illegible]	[illegible]
Work Output	87	Level of physical exertion	[illegible]	[illegible]	[illegible]
Work Output	88	Sitting	[illegible]	[illegible]	[illegible]
Work Output	89	Standing	[illegible]	[illegible]	[illegible]
Work Output	90	Walking/running	[illegible]	[illegible]	[illegible]
Work Output	91	Climbing	[illegible]	[illegible]	[illegible]
Work Output	92	Kneeling/stooping	[illegible]	[illegible]	[illegible]
Work Output	93	Finger manipulation	[illegible]	[illegible]	[illegible]
Work Output	94	Hand-arm manipulation	[illegible]	[illegible]	[illegible]
Work Output	95	Hand-arm steadiness	[illegible]	[illegible]	[illegible]
Work Output	96	Eye-hand/foot coordination	[illegible]	[illegible]	[illegible]
Work Output	97	Limb move no visual control	[illegible]	[illegible]	[illegible]
Work Output	98	Hand-ear coordination	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	99	Advising	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	100	Negotiating	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	101	Persuading	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	102	Instructing	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	103	Interviewing	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	104	Routine information exchange	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	105	Non-routine info exchange	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	106	Public speaking	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	107	Writing	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	108	Signaling	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	109	Code communications	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	110	Entertaining	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	111	Serving/catering	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	112	Job-required personal contact	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	113	Executives/officials	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	114	Middle management/staff	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	115	Supervisors	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	116	Professional personnel	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	117	Semi-professional personnel	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	118	Clerical personnel	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	119	Manual and service workers	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	120	Sales personnel	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	121	Buyers	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	122	Public customers	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	123	The public	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	124	Students/trainees/apprentices	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	125	Clients/patients/counselees	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	126	Special interest groups	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	128	Supervision/non supervisory pers.	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	129	Direction/supervis. personnel	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	130	# personnel for whom responsible	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	131	Supervises non-employees	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	132	Coordinates activities	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	133	Staff functions	[illegible]	[illegible]	[illegible]
Relationships with Other Persons	134	Supervision received	[illegible]	[illegible]	[illegible]
Job Context	135	Out-of-door environment	[illegible]	[illegible]	[illegible]
Job Context	136	High temperature	[illegible]	[illegible]	[illegible]
Job Context	137	Low temperature	[illegible]	[illegible]	[illegible]
Job Context	138	Air contamination	[illegible]	[illegible]	[illegible]
Job Context	139	Vibration	[illegible]	[illegible]	[illegible]
Job Context	140	Improper illumination	[illegible]	[illegible]	[illegible]
Job Context	141	Dirty environment	[illegible]	[illegible]	[illegible]
Job Context	142	Awkward or confining space	[illegible]	[illegible]	[illegible]
Job Context	143	Noise intensity	[illegible]	[illegible]	[illegible]
Job Context	144	First-aid cases	[illegible]	[illegible]	[illegible]
Job Context	145	Temporary disability	[illegible]	[illegible]	[illegible]
Job Context	146	Permanent partial impairment	[illegible]	[illegible]	[illegible]
Job Context	147	Permanent total disab./death	[illegible]	[illegible]	[illegible]
Job Context	148	Civic obligations	[illegible]	[illegible]	[illegible]
Job Context	149	Frustrating situations	[illegible]	[illegible]	[illegible]
Job Context	150	Strained personal contacts	[illegible]	[illegible]	[illegible]
Job Context	151	Personal sacrifice	[illegible]	[illegible]	[illegible]
Job Context	152	Interpersonal conflict sit	[illegible]	[illegible]	[illegible]
Job Context	153	Non-job req social contact	[illegible]	[illegible]	[illegible]
Other Job Characteristics	154	Business suit or dress	[illegible]	[illegible]	[illegible]
Other Job Characteristics	155	Specific uniform/apparel	[illegible]	[illegible]	[illegible]
Other Job Characteristics	156	Work clothing	[illegible]	[illegible]	[illegible]
Other Job Characteristics	157	Protective clothing or gear	[illegible]	[illegible]	[illegible]
Other Job Characteristics	158	Informal attire	[illegible]	[illegible]	[illegible]
Other Job Characteristics	159	Apparel style optional	[illegible]	[illegible]	[illegible]
Other Job Characteristics	160	Regular work	[illegible]	[illegible]	[illegible]
Other Job Characteristics	162	Irregular work	[illegible]	[illegible]	[illegible]
Other Job Characteristics	163	Regular hours	[illegible]	[illegible]	[illegible]
Other Job Characteristics	164	Variable shift work	[illegible]	[illegible]	[illegible]
Other Job Characteristics	165	Irregular hours	[illegible]	[illegible]	[illegible]
Other Job Characteristics	166	Typical day hours	[illegible]	[illegible]	[illegible]
Other Job Characteristics	167	Typical night hours	[illegible]	[illegible]	[illegible]
Other Job Characteristics	168	Typical day and night hours	[illegible]	[illegible]	[illegible]
Other Job Characteristics	169	Specified work pace	[illegible]	[illegible]	[illegible]
Other Job Characteristics	170	Repetitive activities	[illegible]	[illegible]	[illegible]
Other Job Characteristics	171	Cycled work activities	[illegible]	[illegible]	[illegible]
Other Job Characteristics	172	Following set procedures	[illegible]	[illegible]	[illegible]
Other Job Characteristics	173	Time pressure of situation	[illegible]	[illegible]	[illegible]
Other Job Characteristics	174	Precision	[illegible]	[illegible]	[illegible]
Other Job Characteristics	175	Attention to detail	[illegible]	[illegible]	[illegible]
Other Job Characteristics	176	Recognition	[illegible]	[illegible]	[illegible]
Other Job Characteristics	177	Vigilance: infreq. events	[illegible]	[illegible]	[illegible]
Other Job Characteristics	178	Vigilance: cont chang. events	[illegible]	[illegible]	[illegible]
Other Job Characteristics	179	Working under distractions	[illegible]	[illegible]	[illegible]
Other Job Characteristics	180	Updating job knowledge	[illegible]	[illegible]	[illegible]
Other Job Characteristics	181	Travel	[illegible]	[illegible]	[illegible]
Other Job Characteristics	183	Responsibility: safety	[illegible]	[illegible]	[illegible]
Other Job Characteristics	184	Respons. material assets	[illegible]	[illegible]	[illegible]
Other Job Characteristics	185	General responsibility	[illegible]	[illegible]	[illegible]
Other Job Characteristics	186	Job structure	[illegible]	[illegible]	[illegible]
Other Job Characteristics	187	Criticality of position	[illegible]	[illegible]	[illegible]

RATINGS FOR JOB ELEMENTS

ALYSIS QUESTIONNAIRE (PAQ)

Attributes

Job Elements

	Job Elements
1	Written materials
2	Quantitative materials
3	Pictorial materials
4	Patterns/related devices
5	Visual displays
6	Measuring devices
7	Mechanical devices
8	Materials in process
9	Materials not in process
10	Features of nature
11	Man-made environment
12	Behavior
13	Events or circumstances
14	Art or decor
15	Verbal sources
16	Non-verbal sounds
17	Touch
18	Odor
19	Taste
20	Near visual differentiation
21	Far visual differentiation
22	Depth perception
23	Color perception
24	Sound pattern recognition
25	Sound differentiation
26	Body movement sensing
27	Body balance
28	Estimating speed mov parts
29	Estimating speed mov obj
30	Estimating speed processes
31	Judging condition/quality
32	Inspecting
33	Estimating quantity
34	Estimating size
35	Estimating time
36	Decision making
37	Reasoning in problem solving
38	Amount of planning/scheduling
39	Combining information
40	Analyzing information
41	Compiling
42	Coding/decoding
43	Transcribing
44	Short-term memory
45	Education
46	Job-related experience
47	Training
48	Using mathematics
49	Man powered precision tools
50	Man powered non-prec tools
51	Long-handle tools
52	Handling devices/tools
53	Powered precision tools
54	Powered non-precision tools
55	Drawing/related devices
56	Applicators
57	Measuring devices
58	Technical/related devices
59	Machines/equipment
60	Activation controls
61	Fixed setting controls
62	Variable setting controls
63	Keyboard devices
64	Frequent adj hand controls
65	Freq adjusted foot controls
66	Continuous hand controls
67	Continuous foot controls
68	Man-powered vehicles
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125	Supervision/non supervisory pers
126	Direction/supervis personnel
127	# personnel for whom respons
128	Supervises non-employees
129	Coordinates activities

30	Man powered precision tools
31	Man powered non-prec tools
32	Long-handle tools
33	Handling devices tools
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35	Powered non-precision tools
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37	Applicators
38	Measuring devices
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162	Irregular work
163	Regular hours
164	Variable shift work
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166	Typical day hours
167	Typical night hours
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171	Varied work activities
172	Following set procedures
173	Time pressure of situation
174	Precision
175	Attention to detail
176	Recognition
177	Vigilance infreq events
178	Vigilance cont chang events
179	Working under distractions
180	Updating job knowledge
181	Travel
183	Responsibility safety
184	Respons material assets
185	General responsibility
186	Job structure
187	Criticality of position

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