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COMPONENT ANALYSES OF THE ATTRIBUTE DATA BASED ON THE POSITION ANALYSIS QUESTIONNAIRE (PAQ)

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13. ABSTRACT

The basic aim of this study was to identify the underlying dimensions of a set of attribute rating data made up of the attribute profiles of the job elements of the Position Analysis Questionnaire (PAQ). The PAQ is a structured job analysis questionnaire that provides for analyzing jobs in terms of 196 job elements. The attribute profiles consisted of median ratings of the relevance of each of 76 human "attributes" to the job elements in the PAQ. The statistical procedure of principal components analysis was used to ascertain these dimensions. The use of component analysis was directed at answering two different questions about the nature of the attribute data. First, the question of the attribute dimensions underlying the attributes as profiled across the job elements of the PAQ was investigated using a traditional R-type component analysis. Three separate R-type component analyses, using either all of the attributes or one of two subsets of those attributes, were performed, and 20 dimensions were identified and interpreted. Secondly, the question of the job element dimensions underlying the various PAQ job elements as profiled across the various attributes was investigated using an inverse or Q-type component analysis. Six separate Q-type component analyses, each using only the job elements in one of the six PAQ divisions, were performed, and a total of 23 dimensions were identified and interpreted. The question of the potential utility of these results for personnel selection putposes was discussed.

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INTRODUCTION

One of the major ongoing problems in the fields of industrial psychology and personnel administration is that of the selection and placement of individuals in jobs for which they are qualified. Basic to the solving of the problems associated with doing so, however, is some knowledge of the various characteristics of individuals (aptitudes, preferences, etc.), and of the jobs for which individuals are to be considered. Knowledge of the characteristics of individuals has typically been obtained through the use of various tests of abilities, aptitudes, and preferences, through the use of job application forms containing various items of a biographical nature, and from personnel interviews. These pieces of individual data are normally used as the predictors in validation studies using turnover, performance, etc. as criteria. If a test or other predictor is then found to be a valid predictor of the criterion it is assumed that the ability which that test or other predictor measures or reflects is required for performance on the job.

It can be argued, however, that this empirical method of determining job requirements puts the cart before the horse in a theoretical sense in terms of the manner in which job requirements are determined, because it does not start with a systematic analysis of the characteristics of the jobs themselves. In this regard, while the empirical approach to the determination of job requirements has proven to be of utility, it does not systematically take into account a full knowledge of the nature of the jobs themselves, and is thus in some ways a "shot-gun" approach. (This is not to deny, however, the fact that this approach has worked well in the hands of experienced and knowledgeable persons in the field.) It would seem logical then that the requirements of jobs might begin with systematically obtained knowledge of the activities and characteristics of the jobs themselves. After such knowledge is available, the topic of the selection devices to be used for determining if a given person has the ability to perform a given job could then be addressed. In such a paradigm, the job is assessed first and the selection device second, rather than vice versa as in the case of the empirical approach. What is needed in this regard, therefore, is a method of systematically assessing the characteristics of jobs and the human traits or abilities which are necessary for the performance of various job activities.

The job analysis literature does include a few systematic methods which have been developed over the years for assessing human traits required for performing various job activities. Viteles (1922, 1932), for example, developed an instrument called the "Job Psychograph" which he used as the basis for estimating what traits were required of workers in the performance of their jobs. Knowledge of the importance of various traits to jobs could then be used to indicate what types of tests might be useful in predicting performance on a given job. The "Occupational Characteristics Check-List" developed by the U.S. Employment Service

during the 1930's, and later called the "Worker Characteristics Form," was also designed for these types of purposes (Stead and Shartle, 1940; Otis and Leukart, 1954). Trattner, Fine, and Kubis (1955) and McCormick, Finn, and Scheips (1957) worked along these lines by determining the extent to which various human attributes were relevant for the performance of various jobs. The J-Coefficient (Primoff, 1953, 1955, 1957, 1959; Wherry, 1955) is yet another example of efforts in the direction of the establishment of job requirements based on job analytic data. Using the J-Coefficient procedure it was possible to estimate the correlation between test scores and a job performance criterion without ever performing a direct empirical validation of the test. Wherry (1955) reports data which show rank-order correlations between the J-Coefficient and actual test validities ranging from .51 to .90. Finally, the Functional Job Analysis approach of Fine (Fine and Wiley, 1971) offers another approach which has been used to indicate what types of skills or abilities are required in the of a job. Thus, the idea that the human abilities which are required for performance of given job activities can be ascertained from a systematic job analysis does seem to have some support in the literature.

The Development of Attribute Data Based on the Position Analysis Questionnaire (PAQ)

McCormick, Jeanneret, and Mecham (1969) have developed a structured job analysis instrument called the Position Analysis Questionnaire (PAQ) which consists of 194 job elements divided into six divisions based upon a stimulus-organism-response paradigm. Through the use of this instrument, virtually any job can be analyzed in terms of the extent to which the activities or situations represented by each of the job elements are present in the job. (The PAQ provides various types of response scales for use with the different job elements, these scales including importance to the job, extent of use of given things, amount of time spent, etc.) Based upon previous work with the PAQ (actually component analyses of the data resulting from the analysis of 536 jobs with the PAQ), it is possible to characterize jobs in terms of the degree to which each of 32 job dimensions are important to the job. These 32 job dimensions may be thought of as general groupings of activities which may be used to characterize the structure of various jobs.

In order to extend the utility of the PAQ into the area of the determination of what human traits or attributes are required for the performance of various job activities, Marquardt and McCormick (1972) and Mecham and McCormick (1968) obtained data concerning the relevance of various human and situational attributes to the job elements of the PAQ. A list of 76 attributes (49 of an "aptitudinal" nature, and 27 of a "situational" nature) and their definitions was first assembled. (See Appendix A for a list of these attributes.)[1] Next, a number of

[1]It should be noted that the attributes as listed in this appendix and in the tables included in this report are in a different order than that given in Marquardt and McCormick (1972).

raters, largely obtained from among industrial psychologists who were members of Division 14 of the American Psychological Association, were asked to rate the relevance or importance (on a 6-point Likert scale) of each of these attributes to each of the job elements of the PAQ. (PAQ job elements 44, 60, 127, 160, and 181 were omitted from this procedure as these job elements are open-ended in nature, and job elements 188 through 194 were omitted because they deal with pay/income.) A minimum of 8 and a maximum of 12 raters rated the relevance of each of the attributes to each of the 182 PAQ job elements used in this study. The several relevance ratings for each of the attributes for any given PAQ job element were used in computing a median value for the relevance of that attribute to that job element. When viewed in terms of each of the job elements separately, the median attribute ratings across all of the attributes may be thought of as representing a profile of the estimated attribute requirements of the job activities reflected by each of the job elements of the PAQ. The reliability of the ratings was found to be generally adequate (the reliability coefficients of the pooled ratings generally ranged from .80 to the upper .90's).

Purpose and Scope of the Present Study

The present study is a preliminary to the further exploration of the "structure" of jobs, and the utility of the PAQ with regard to determining job requirements. Job requirements based on PAQ analyses might then be useful for the determination of the job component validity (what has been called synthetic validity in the past) of various selection devices, or for the determination of what types of selection devices would be most appropriate for use with various jobs.

In order to further this aim, the present study involves the analysis of the attribute data developed by Marquardt and McCormick (1972) to determine the underlying structure of these data. Once such a structure is ascertained, future work might then be directed at testing the utility of these data for various purposes.

PROCEDURE

General Approach

The basic aim of this study was to identify the underlying dimensions of the attribute data made up of the attribute profiles of the job elements of the PAQ. The statistical procedure of principal components analysis was used to ascertain these dimensions. In general, this procedure may be viewed as identifying a set of dimensions which form a basis (in a mathematical sense) for the matrix of raw data, thus providing a set of dimensions which prove useful in characterizing jobs in terms of their attribute requirements.

In this study, the use of component analysis was directed at answering two different questions about the nature of the attribute data.

First, the question of the attribute dimensions underlying the attributes as profiled across the job elements of the PAQ was investigated using a traditional R-type component analysis. A principal components solution followed by a Varimax rotation was employed, using 1.0's entered on the diagonal of the correlation matrix, and with the restriction that the extraction of components terminate when the eigenvalue became less than 1.0. Secondly, the question of the job element dimensions underlying the various job elements of the PAQ as profiled across the various attributes was investigated using an inverse or Q-type component analysis. In this case, the job elements of the PAQ were considered as "variables," and the attributes as the "cases." Again, a principal components solution followed by a Varimax rotation was employed, with 1.0's entered on the diagonal of the correlation matrix with the restriction that the extraction of components terminate when the eigenvalue became less than 1.0.

Specific Analyses Performed

Since the overall set of attributes was composed of two distinct subsets of attributes (those of an "aptitudinal" nature and those of a "situational" nature) three separate R-type component analyses were performed to identify the dimensions underlying the attributes as profiled across the various PAQ job elements. These three analyses were: (1) a component analysis of all of the attributes; (2) a component analysis of only the aptitudinal attributes; and (3) a component analysis of only the situational attributes.

Next, since the job elements of the PAQ are subdivided into six divisions (Information Input, Mental Processes, Work Output, Relationships With Other Persons, Job Context, and Other Job Characteristics), separate Q-type component analyses were performed using the job elements from each of the six PAQ divisions separately. Since the ratio of variables to cases was low when all of the job elements together were considered, it was decided that an overall component analysis of all of the job elements should not be performed.

It should be noted with relation to all of these analyses that attributes 50, 66, 67, 72, and 76 were excluded from the analyses due to low reliability of the ratings of these attributes (the cutoff for exclusion was $r = .75$), and that PAQ job elements 188-194 (dealing with pay/income) and 44, 60, 127, 160, and 181 (which are open-ended in nature) were excluded as no attribute data had been obtained for these job elements. Thus, 71 attributes and 182 job elements were used in various combinations for these analyses.

RESULTS

Identification Scheme for Dimensions

An identification scheme has been established for the set of dimensions which assigns a unique alphanumeric label to each of the dimensions. The first character of the label is the letter "A" for all dimensions reported in this study, and signifies that the basic raw data used were attribute ratings. The second character of the label, in the case of the R-type component analyses, is the letter "G" (General) standing for a dimension obtained from an analysis using all of the attributes, the letter "A" standing for a dimension resulting from an analysis using only the aptitudinal attributes, and the letter "S" standing for a dimension resulting from an analysis using only the situational attributes. The second character of label, in the case of the Q-type component analyses, is a number from 1 to 6 denoting which of the six PAQ divisions was used in the analysis. Finally, the last character of the label is a number which denotes the dimension itself. In the case of the three R-type analyses these numbers start at 1 for each of the three sets of analyses, and continue consecutively until all of the dimensions in that set have been numbered. In the case of the six Q-type analyses these numbers start at 1 for the first dimension of the first PAQ division, and continue consecutively through 23 which is the last dimension of the last PAQ division. A summary table (Table No. 10) of this classification scheme is given at the end of the results section.

Components Resulting from the Analysis of All of the Attributes

The principal components solution of the 71 attribute correlation matrix computed using 182 job elements of the PAQ yielded a total of 9 principal components accounting for about 84% of the variance. These components were rotated orthogonally (using a Varimax rotation) to enable greater interpretability. The attributes receiving substantial loadings on these dimensions are presented in Table 1. The component loadings presented in Table 1 and all subsequent tables have been rounded to two places, and the decimals omitted. In addition, when the loadings of all of the job elements in a given dimension were all negative, the minus signs were all omitted from the table. In such cases a footnote noting this fact appears at the bottom of the appropriate tables. The interpretations associated with the various components presented in Table 1 are given below.

Dimension AG-1: Cognitive and Interpersonal Skills. This was the first dimension to be extracted by the component analysis, and it accounted for 23.6% of the variance. This is a relatively broad dimension, with a large number of attributes loading on it. The primary emphasis of this dimension seems to be twofold, dealing with both cognitive and interpersonal skills. These two emphases, however, both loaded in the same direction (positively).

Dimension AG-2: General Physical Skills. The second dimension accounted for 22.4% of the variance. It too is a relatively broad dimension characterized generally by skills which are of a general physical nature.

Table 1

Attribute Dimensions Based on Component Analysis of All Attributes

	Attribute Dimension	Rotated Loading[a]
Dimension AG-1: Cognitive and Interpersonal Skills		
3	Oral communication	92
59	Empathy	90
55	Dealing with people	89
42	Ideational fluency	88
57	Influencing people	87
2	Word fluency	86
1	Verbal comprehension	86
43	Originality	84
69	Prestige/esteem from others	84
68	Stage presence	82
78	Directing/controlling/planning	81
73	Interpretation from personal viewpoint	79
75	Dealing with concepts/information	79
8	Intelligence	73
56	Social welfare	73
6	Convergent thinking	69
44	Problem sensitivity	69
7	Divergent thinking	68
61	Conflicting/ambiguous information	68
47	Time sharing	67
9	Long-term memory	66
10	Short-term memory	64
21	Auditory acuity	60
46	Selective attention	47
5	Arithmetic reasoning	45
51	Repetitive/short-cycle operations	-47
Dimension AG-2: General Physical Skills		
37	Dynamic strength	92
26	Kinesthesis	91
38	Static strength	90
32	Rate of arm movement	89
39	Explosive strength	87
31	Continuous muscular control	85
34	Eye-hand-foot coordination	83
36	Response integration	82
29	Arm/hand positioning	82
33	Eye-hand coordination	79
25	Body orientation	79
30	Arm/hand steadiness	77

Table 1 (cont.)

Attribute Dimension		Rotated Loading[a]
Dimension AG-2 (cont.)		
48	Stamina	77
24	Tactual acuity	75
28	Manual dexterity	73
27	Finger dexterity	60
40	Rate control	58
52	Dealing with things/objects	53
45	Spatial orientation	52
60	Personal risk	49
35	Simple reaction time	47
74	Susceptibility to fatigue	46
Dimension AG-3: Sensory/Judgmental/Memory Demands[b]		
64	Attainment of set standards	77
71	Sensory/judgmental criteria	76
46	Selective attention	73
63	Sensory alertness	70
62	Pressure of time	63
14	Closure	62
47	Time sharing	59
61	Conflicting/ambiguous information	53
9	Long-term memory	53
10	Short-term memory	50
41	Mechanical ability	50
44	Problem sensitivity	50
8	Intelligence	47
Dimension AG-4: Visual Discrimination/Perception		
20	Color discrimination	85
18	Far visual acuity	84
19	Depth perception	81
12	Visual form perception	79
16	Spatial visualization	77
13	Perceptual speed	68
17	Near visual acuity	65
45	Spatial orientation	59
15	Movement detection	56
14	Closure	48
Dimension AG-5: Quantitative/Technical Demands		
4	Numerical computation	79
5	Arithmetic reasoning	68
54	Scientific/technical activities	63
53	Processes/machines/techniques	49

Table 1 (cont.)

Attribute Dimension	Rotated Loading[a]
Dimension AG-6: Psychomotor Skills[b]	
27 Finger dexterity	66
70 Tangible/physical end-products	54
28 Manual dexterity	53
30 Arm/hand positioning	46
Dimension AG-7: Aesthetic Judgment/Originality versus Perceptual/Response Demands	
11 Aesthetic judgment	60
21 Auditory acuity	-56
35 Simple reaction time	-50
Dimension AG-8: Chemical Senses[b]	
22 Olfactory acuity	88
23 Gustatory acuity	87
Dimension AG-9: Work Pressures/Risks	
74 Susceptibility to fatigue	74
60 Personal risk	58

[a]Loadings below 45 not reported.

[b]All attribute loadings on this dimension were negative.

Dimension AG-3: Sensory/Judgmental/Memory Demands. The third dimension accounted for 10.1% of the variance. Compared to the first two dimensions, this dimension was relatively harder to interpret as it seems to have three primary thrusts. The sensory, judgmental, and memory demands which characterize this dimension, however, seem to logically fit a sensing-processing-storage type paradigm.

Dimension AG-4: Visual Discrimination/Perception. The fourth dimension accounted for 10.8% of the variance. It is a relatively homogeneous dimension characterized by skills which require the visual discrimination and perception of objects in the field of vision.

Dimension AG-5: Quantitative/Technical Demands. The fifth dimension accounted for 5.3% of the variance. It seems to be clearly a technical demands type of dimension which explains the heavy loading of quantitative skills on the dimension.

Dimension AG-6: Psychomotor Skills. The sixth dimension accounted for 4.1% of the variance. It is characterized by various psychomotor types of skills.

Dimension AG-7: Aesthetic Judgement/Originality versus Perceptual/Response Demands. The seventh dimension accounted for 2.5% of the variance. This is a bipolar dimension, one end reflecting the concepts of originality and aesthetics, and the other end reflecting the perception of stimuli and reaction to them. (This dimension was interpreted partially through the use of attributes with loadings less than the cutoff value, as interpretation simply on the basis of those three attributes which loaded significantly was difficult.)

Dimension AG-8: Chemical Senses. The eighth dimension accounted for 2.9% of the variance, and is characterized by senses of a chemical nature.

Dimension AG-9: Work Pressures/Risks. The final dimension obtained from this analysis accounted for 2.6% of the variance. It is characterized by situations which involve risk or place strains upon the individual.

Components Resulting from the Analysis of the Aptitudinal Attributes

The principal components solution of the 49 attribute correlation matrix computed using 182 job elements of the PAQ, and only the aptitudinal attributes, yielded a total of 7 principal components accounting for about 84% of the variance. The attributes receiving substantial loadings on these dimensions are presented in Table 2. The interpretations associated with the various components presented in Table 2 are given below.

Dimension AA-1: General Physical Skills. This dimension accounted for 26.7% of the variance, and is characterized by attributes which reflect the use of general physical types of skills. This dimension was so similar to the previously mentioned dimension AG-2 that it was given the same title.

Table 2

Attribute Dimensions Based on Component Analysis of Aptitudinal Attributes

Attribute Dimension		Rotated Loading[a]
Dimension AA-1: General Physical Skills[b]		
37	Dynamic strength	93
38	Static strength	93
49	Speed of limb movement	90
39	Explosive strength	90
26	Kinesthesis	88
32	Rate of arm movement	85
31	Continuous muscular control	84
48	Stamina	83
34	Eye-hand-foot coordination	82
25	Body orientation	81
36	Response integration	80
29	Arm/hand positioning	74
33	Eye-hand coordination	73
30	Arm/hand steadiness	69
24	Tactual acuity	69
28	Manual dexterity	64
40	Rate control	56
45	Spatial orientation	51
27	Finger dexterity	50
35	Simple reaction time	45
Dimension AA-2: Cognitive Skills[b]		
8	Intelligence	92
9	Long-term memory	87
47	Time sharing	87
44	Problem sensitivity	86
1	Verbal comprehension	86
10	Short-term memory	86
3	Oral communication	82
6	Convergent thinking	82
2	Word fluency	81
42	Ideational fluency	79
7	Divergent thinking	77
43	Originality	77
46	Selective attention	74
5	Arithmetic reasoning	67
14	Closure	60
21	Auditory acuity	58
4	Numerical computation	48

Table 2 (cont.)

Attribute Dimension		Rotated Loading[a]
Dimension AA-3: Visual Perception/Interpretation[b]		
12	Visual form perception	90
16	Spatial visualization	89
19	Depth perception	82
20	Color discrimination	82
18	Far visual acuity	81
13	Perceptual speed	80
17	Near visual acuity	73
72	Spatial orientation	72
41	Mechanical ability	69
15	Movement detection	67
14	Closure	61
40	Rate control	50
11	Aesthetic judgment	49
35	Simple reaction time	45
Dimension AA-4: Psychomotor Skills		
27	Finger dexterity	76
28	Manual dexterity	65
30	Arm/hand steadiness	59
29	Arm/hand positioning	57
33	Eye-hand coordination	49
24	Tactual acuity	45
Dimension AA-5: Physical Response/Coordination versus Imaginative Orientation		
35	Simple reaction time	60
40	Rate control	48
15	Movement detection	45
11	Aesthetic judgment	-62
Dimension AA-6: Quantitative Skills		
4	Numerical computation	71
5	Arithmetic reasoning	53
21	Auditory acuity	-48
Dimension AA-7: Chemical Senses[b]		
23	Gustatory acuity	92
22	Olfactory acuity	88

[a]Loadings below 45 not reported.

[b]All attribute loadings on this dimension were negative.

Dimension AA-2: Cognitive Skills. This dimension accounted for 22.4% of the variance, and consists generally of various cognitive types of skills which may be required on a job. It is similar to dimension AG-1 in this regard, but does not reflect the interpersonal skills also found in that dimension.

Dimension AA-3: Visual Perception/Interpretation. This dimension accounted for 18.5% of the variance, and is characterized by skills which require visual perception of various sorts, and then the interpretation of that which is sensed. It is somewhat similar to dimension AG-4, but is more heavily loaded on interpretation types of skills than is that dimension.

Dimension AA-4: Psychomotor Skills. This dimension accounted for 6.1% of the variance, and is primarily characterized by various psychomotor types of skills. It is so similar to dimension AG-6 that both were given the same title.

Dimension AA-5: Physical Response/Coordination versus Imaginative Orientation. This dimension accounted for 3.7% of the variance. It is a bipolar dimension characterized by aesthetics, originality, and ideational fluency at one end, and by physical responses to stimuli and general coordination skills at the other end. (The interpretation of this dimension was facilitated by looking at the attributes which did not load above the cutoff, as well as at those that did. This was especially helpful with regard to the imaginative end of this dimension.)

Dimension AA-6: Quantitative Skills. This dimension accounted for 3.3% of the variance, and is primarily concerned with skills of a numerical or quantitative nature. It is somewhat similar to dimension AG-5, but does not include the technical demands of that dimension.

Dimension AA-7: Chemical Senses. This dimension accounted for 3.8% of the variance, and is so similar to dimension AG-8 that they have been given the same label (actually, the attributes loading significantly on these two dimensions are identical; their actual loadings merely differ slightly).

Components Resulting from the Analysis of the Situational Attributes

The principal components solution of the 22 attribute correlation matrix computed using 182 job elements of the PAQ, and only the situational attributes, yielded a total of 4 principal components accounting for 79% of the variance. The attributes receiving substantial loadings on these dimensions are presented in Table 3. The interpretations associated with the various components presented in Table 3 are given below.

Dimension AS-1: Social/Intellectual Orientation. This dimension accounted for 35.1% of the variance, and is a dimension primarily characterized by situations which require either a social or an intellectual orientation on the part of the individual.

Table 3

Attribute Dimensions Based on Component Analysis of Situational Attributes

Attribute Dimension		Rotated Loading[a]
Dimension AS-1: Social/Intellectual Orientation		
55	Dealing with people	-94
59	Empathy	-92
57	Influencing people	-92
68	Stage presence	-88
58	Directing/controlling/planning	-86
73	Interpretation from personal viewpoint	-85
56	Social welfare	-81
69	Prestige/esteem from others	-77
75	Dealing with concepts/information	-73
61	Conflicting/ambiguous information	-64
52	Dealing with things/objects	53
Dimension AS-2: Sensory/Judgmental Demands		
71	Sensory/judgmental criteria	88
54	Scientific/technical activities	76
64	Attainment of set standards	72
63	Sensory alertness	67
61	Conflicting/ambiguous information	66
62	Pressure of time	53
53	Processes/machines/techniques	49
Dimension AS-3: Structured Work Situations[b]		
70	Tangible/physical end-products	82
51	Repetitive/short-cycle operations	77
65	Working under specific instructions	72
53	Processes/machines/techniques	65
52	Dealing with things/objects	59
64	Attainment of set standards	54
62	Pressure of time	52
Dimension AS-4: Work Pressures/Risks[b]		
74	Susceptability to fatigue	88
60	Personal risk	74
63	Sensory alertness	57

[a]Loadings below 45 not reported.

[b]All attribute loadings on this dimension were negative.

Dimension AS-2: Sensory/Judgmental Demands. This dimension accounted for 17.7% of the variance. It is primarily characterized by situations which place sensory and judgmental demands upon the individual.

Dimension AS-3: Structured Work Situations. This dimension accounted for 16.1% of the variance. It is characterized by situations which are structured in some sense, and which thus place demands upon the individual which are more or less controlled by the situation rather than by the individual.

Dimension AS-4: Work Pressures/Risks. This dimension accounted for 10.8% of the variance. It is a dimension which is primarily characterized by situations which place various pressures on the individual which may be risky or hazardous to him.

Components Resulting from the Analysis of PAQ Job Elements: Division 1, Information Input

The Q-type principal components solution of the 36 job element correlation matrix computed using all 71 of the attributes and those job elements in the Information Input division of the PAQ (job elements 1-35) yielded a total of 5 principal components accounting for 84% of the variance. The job elements receiving substantial loadings on these dimensions are presented in Table 4. The interpretations associated with the various components presented in Table 4 are given below. (It should be noted that in this and all subsequent analyses of the job elements in the various divisions of the PAQ, job element 186, "Job Structure," was included as a marker variable to facilitate interpretation of the dimensions.)

Dimension A1-1: Visual Input from Devices/Materials. This dimension accounted for 24.5% of the variance. It is a relatively broad dimension characterized primarily by job activities which require the use of visual information input from various devices or materials that are dealt with on the job.

Dimension A1-2. Evaluation of Visual Input. This dimension accounted for 16.1% of the variance. Unlike the previous dimension which was characterized by visual inputs to the individual, this dimension is primarily characterized by job activities which require the evaluation of the visual information input rather than its mere sensing.

Dimension A1-3: Perceptual Input from Processes/Events. This dimension accounted for 17.8% of the variance. It is primarily characterized by information input which is of a perceptual nature, in that the individual must recognize and evaluate to some extent the information he is receiving from the various processes taking place or the events in his work environment.

Dimension A1-4: Verbal/Auditory Input/Interpretation. This dimension accounted for 12.8% of the variance. It is characterized primarily by information which the individual receives through verbal or auditory channels.

Table 4

Job Element Dimensions Based on Component Analysis of Job Element Attribute Profiles: PAQ Division 1--Information Input

Attribute Dimension		Rotated Loading[a]
Dimension A1-1: Visual Input from Devices/Materials		
6	Measuring devices	89
4	Patterns/related devices	87
8	Materials in process	80
9	Materials not in process	79
7	Mechanical devices	75
2	Quantitative materials	74
32	Inspecting	69
3	Pictorial materials	67
33	Estimating quantity	66
1	Written materials	61
34	Estimating size	61
5	Visual displays	57
20	Near visual differentiation	54
30	Estimating speed of processes	49
31	Judging condition/quality	49
Dimension A1-2: Evaluation of Visual Input[b]		
14	Art or decor	86
10	Features of nature	76
11	Man-made features of environment	72
23	Color perception	66
31	Judging condition/quality	61
12	Behavior	56
22	Depth perception	55
21	Far visual differentiation	53
32	Inspecting	50
3	Pictorial materials	49
34	Estimating size	45
Dimension A1-3: Perceptual Input from Processes/Events		
29	Estimating speed of moving objects	82
28	Estimating speed of moving parts	79
13	Events or circumstances	71
21	Far visual differentiation	70
30	Estimating speed of processes	69
22	Depth perception	67
5	Visual displays	63
35	Estimating time	50
12	Behavior	48
7	Mechanical devices	46
20	Near visual differentiation	46

Table 4 (cont.)

Attribute Dimension		Rotated Loading[a]
Dimension A1-4: Verbal/Auditory Input/Interpretation[b]		
15	Verbal sources	90
186	Job structure	72
1	Written materials	66
35	Estimating time	55
24	Sound pattern recognition	54
16	Nonverbal sounds	54
25	Sound differentiation	51
12	Behavior	48
18	Odor	46
2	Quantitative materials	45
Dimension A1-5: Non-Visual Input[b]		
27	Body balance	78
26	Body movement sensing	76
17	Touch	72
18	Odor	66
19	Taste	65
25	Sound differentiation	65
16	Nonverbal sounds	56
24	Sound pattern recognition	54

[a]Loadings below 45 not reported.

[b]All job element loadings on this dimension were negative.

Dimension A1-5: Non-Visual Input. This dimension accounted for 13.3% of the variance. It is primarily concerned with a variety of non-visual sources of job information, and is relatively broad with regard to these non-visual types of information input.

Components Resulting from the Analysis of PAQ Job Elements: Division 2, Mental Processes

The Q-type principal components solution of the 14 job element correlation matrix computed using all 71 of the attributes and those job elements in the Mental Processes division of the PAQ (job elements 36-49) yielded a total of 2 principal components accounting for 82% of the variance. The job elements receiving substantial loadings on these dimensions are presented in Table 5. The interpretations associated with the various components presented in Table 5 are given below.

Dimension A2-6: Use of Job-Related Knowledge. This dimension accounted for 50% of the variance. It is relatively broad, and contains a number of job elements. It is primarily characterized by job activities that require the use of job-related knowledge in the performance of the job.

Dimension A2-7: Information Processing. This dimension accounted for 31.9% of the variance, and is primarily concerned with the processing of information which is received on the job. The types of information which are processed may be quite varied, and it is thus the common element of the processing of information which is characteristic of this dimension.

Components Resulting from the Analysis of PAQ Job Elements: Division 3, Work Output

The Q-type principal components solution to the 49 job element correlation matrix computed using all of the 71 attributes and those job elements in the Work Output division of the PAQ (job elements 50-98) yielded a total of 4 principal components accounting for 85% of the variance. The job elements receiving substantial loadings on these dimensions are presented in Table 6. The interpretations associated with the various components presented in Table 6 are given below.

Dimension A3-8: Manual Control/Coordination Activities. This dimension accounted for 34.5% of the variance. It is a very broad dimension including a number of PAQ job elements, and is largely characterized by job activities which involve the use of control devices of various sorts. It is also characterized by various activities which require muscular or limb coordination.

Dimension A3-9: Control/Equipment Operation. This dimension accounted for 24.1% of the variance. It too is a broad dimension containing significant loadings for many job elements, and is largely characterized by job activities which involve the operation of equipment and the control devices used to do so.

Dimension A3-10: General Body/Handling Activities. This dimension accounted for 22.9% of the variance. It is primarily characterized by job activities which require general body movement and the physical handling of various types of materials.

Table 5

Job Element Dimensions Based on Component Analysis of Job Element Attributes Profiles: PAQ Division 2--Mental Processes

	Attribute Dimension	Rotated Loading[a]
Dimension A2-6: Use of Job-Related Knowledge		
37	Reasoning in problem solving	86
36	Decision making	85
47	Job-related experience	84
46	Education	82
48	Training	82
186	Job structure	80
38	Amount of planning/scheduling	79
40	Analyzing information	72
39	Combining information	70
49	Using mathematics	65
45	Short-term memory	65
41	Compiling	49
Dimension A2-7: Information Processing[b]		
43	Transcribing	92
42	Coding/decoding	91
41	Compiling	79
39	Combining information	63
40	Analyzing information	63
49	Using mathematics	57
45	Short-term memory	49

[a]Loadings below 45 not reported.

[b]All job element loadings on this dimension were negative.

Table 6

Job Element Dimensions Based on Component Analysis of Job Element Attribute Profiles: PAQ Division 3--Work Output

Attribute Dimension		Rotated Loading[a]
Dimension A3-8: Manual Control/Coordination Activities		
58	Measuring devices	93
93	Finger manipulation	88
56	Drawing and related devices	87
50	Manually powered precision tools/instruments	85
59	Technical and related devices	85
54	Powered precision tools/instruments	80
81	Assembling/disassembling	80
78	Setting up/adjusting	78
64	Variable setting controls	77
95	Hand-arm steadiness	77
65	Keyboard devices	76
94	Hand-arm manipulation	76
57	Applicators	76
79	Manually modifying	76
66	Frequent-adjustment hand-operated controls	68
61	Machines/equipment	67
68	Continuous hand-operated controls	67
97	Limb movement without visual control	66
80	Material-controlling	66
96	Eye-hand/foot coordination	65
51	Manually powered nonprecision tools/instruments	65
82	Arranging/positioning	62
63	Fixed setting controls	61
53	Handling devices/tools	61
55	Powered nonprecision tools/instruments	61
62	Activation controls	60
83	Feeding/off-bearing	59
84	Physical handling	54
52	Long-handle tools	51
98	Hand-ear coordination	49
77	Remote-controlled equipment	45
Dimension A3-9: Control/Equipment Operation		
73	Powered water vehicles	87
74	Air/space vehicles	86
71	Powered highway/rail vehicles	85
76	Operating equipment	83
77	Remote-controlled equipment	82
72	Powered mobile equipment	80

Table 6 (cont.)

Attribute Dimension		Rotated Loading[a]
Dimension A3-9 (cont.)		
70	Man-powered vehicles	70
75	Man-moved mobile equipment	68
69	Continuous foot-operated controls	64
67	Frequent-adjustment foot-operated controls	63
68	Continuous hand-operated controls	58
66	Frequent-adjustment hand-operated controls	57
62	Activation controls	57
63	Fixed setting controls	55
80	Material controlling	55
55	Powered nonprecision tools/instruments	55
61	Machines/equipment	53
96	Eye-hand/foot coordination	51
64	Variable setting controls	49
54	Powered precision tools/instruments	48
83	Feeding/off-bearing	48
98	Hand-ear coordination	48
65	Keyboard devices	45
Dimension A3-10: General Body/Handling Activities		
92	Kneeling/stooping	88
87	Level of physical exertion	86
89	Standing	86
90	Walking/running	84
86	Balancing	82
91	Climbing	82
85	Highly skilled body coordination	80
88	Sitting	78
52	Long-handle tools	62
84	Physical handling	59
53	Handling devices/tools	55
70	Man-powered vehicles	53
75	Man-moved mobile equipment	52
51	Manually powered nonprecision tools/instruments	52
97	Limb movement without visual control	49
83	Feeding/off-bearing	49
95	Hand-arm steadiness	48
82	Arranging/positioning	47
79	Manually modifying	46
94	Hand-arm manipulation	45
Dimension A3-11: Use of Foot Controls		
186	Job structure	75
67	Frequent-adjustment foot-operated controls	47
69	Continuous foot-operated controls	46

[a]Loadings below 45 not reported.

Dimension A3-11: Use of Foot Controls. This dimension accounted for 3.2% of the variance, and includes only those job elements which are concerned with the use of foot-operated controls.

Components Resulting from the Analysis of PAQ Job Elements: Division 4, Relationships With Other Persons

The Q-type principal components solution to the 36 job element correlation matrix computed using all of the 71 attributes and those job elements in the Relationships With Other Persons division of the PAQ (job elements 99-134) yielded a total of 3 principal components accounting for 88% of the variance. The job elements receiving substantial loadings on these dimensions are presented in Table 7. The interpretations associated with the various components presented in Table 7 are given below.

Dimension A4-12: Interpersonal Communications. This dimension accounted for 72.7% of the variance. It is a very broad dimension which includes significant loadings for a large number of job elements. It is primarily characterized by interpersonal communications aimed at various ends and with various types of persons.

Dimension A4-13: Signal/Code Communications. This dimension accounted for 7.2% of the variance, and is characterized by the two PAQ job elements dealing with communicating via code or signals.

Dimension A4-14: Serving/Entertaining. This dimension accounted for 7.9% of the variance, and is characterized by the two PAQ job elements dealing with job activities which involve serving/catering, and entertaining.

Components Resulting from the Analysis of PAQ Job Elements: Division 5, Job Context

The Q-type principal components solution to the 20 job element correlation matrix computed using all of the 71 attributes and those job elements in the Job Context division of the PAQ (job elements 135-153) yielded a total of 3 principal components accounting for 81% of the variance. The job elements receiving substantial loadings on these dimensions are presented in Table 8. The interpretations associated with the various components presented in Table 8 are given below.

Dimension A5-15: Unpleasant Physical Environment. This dimension accounted for 30.8% of the variance. It is characterized by job situations which are generally unpleasant in nature.

Dimension A5-16: Personally Demanding Situations. This dimension accounted for 29.5% of the variance. It is characterized by job situations of largely an interpersonal nature which are demanding upon and/or frustrating for the individual.

Dimension A5-17: Hazardous Physical Environment. This dimension accounted for 20.7% of the variance. It is characterized by job situations which are generally hazardous in nature.

Table 7

Job Element Dimensions Based on Component Analysis of Job Element Attribute Profiles: PAQ Division 4--Relationships With Other Persons

	Attribute Dimension	Rotated Loading[a]
Dimension A4-12: Interpersonal Communications		
133	Staff functions	97
99	Advising	96
100	Negotiating	96
129	Direction of supervisory personnel	96
101	Persuading	96
102	Instructing	96
116	Professional personnel	96
114	Middle management/staff personnel	95
113	Executives/officials	95
105	Nonroutine information exchange	94
103	Interviewing	94
132	Coordinates activities	93
125	Clients/patients/counselees	93
115	Supervisors	93
124	Students/trainees/apprentices	92
126	Special interest groups	92
131	Supervises nonemployees	92
128	Supervision of nonsupervisory personnel	92
121	Buyers	91
130	Total number of personnel for whom responsible	91
117	Semiprofessional personnel	90
134	Supervision received	90
120	Sales personnel	90
106	Public speaking	89
122	Public customers	88
123	The public	87
112	Job-required personal contact	86
118	Clerical personnel	81
107	Writing	79
186	Job structure	74
104	Routine information exchange	73
119	Manual and service workers	70
Dimension A4-13: Signal/Code Communication[b]		
109	Code communications	90
198	Signaling	88
Dimension A4-14: Serving/Entertaining		
111	Serving/catering	81
110	Entertaining	73

[a]Loadings below 45 not reported. [b]All job element loadings on this dimension were negative.

Table 8

Job Element Dimensions Based on Component Analysis of Job Element Attribute Profiles: PAQ Division 5--Job Context

Attribute Dimension		Rotated Loading[a]
Dimension A5-15: Unpleasant Physical Environment		
136	High temperature	95
137	Low temperature	94
141	Dirty environment	87
135	Out-of-door environment	85
139	Vibration	85
138	Air contamination	84
142	Awkward or confining space	83
140	Improper illumination	69
Dimension A5-16: Personally Demanding Situations		
150	Strained personal contacts	95
148	Civic obligations	94
152	Interpersonal conflict situations	93
149	Frustrating situations	93
153	Non-job-required social contact	92
151	Personal sacrifice	91
186	Job structure	69
Dimension A5-17: Hazardous Physical Environment[b]		
146	Permanent partial impairment	95
145	Temporary disability	95
147	Permanent total disability/death	94
144	First-aid cases	93
143	Noise intensity	46

[a]Loadings below 45 not reported.

[b]All job element loadings on this dimension were negative.

Components Resulting from the Analysis of PAQ Job Elements: Division 6, Other Job Characteristics

The Q-type principal components solution to the 32 job element correlation matrix computed using all of the 71 attributes and those job elements in the Other Job Characteristics division of the PAQ (job elements 154-187) yielded a total of 6 principal components accounting for 81% of the variance. The job elements receiving substantial loadings on these dimensions are presented in Table 9. The interpretations associated with the various components presented in Table 9 are given below.

Dimension A6-18: Work Schedule I. This dimension accounted for 18.6% of the variance. It is a dimension characterized by the work shifts or the amount of time the job incumbent usually spends on the job. This dimension is, however, most likely an artifact of the attribute rating data and without real meaning in so far as job activities are concerned. The median attribute ratings across the various attributes for these job elements were almost exclusively composed of ratings of "0" or "no relevance." This would seem to argue for this dimension being *artifactual*.

Dimension A6-19: Job Responsibility. This dimension accounted for 15.2% of the variance. It is largely characterized by job elements which tap the level of responsibility for various things inherent in a job.

Dimension A6-20: Routine/Repetitive Work Activities. This dimension accounted for 12.7% of the variance. It is characterized by job situations and activities which are largely routine and repetitive in nature.

Dimension A6-21: Attentive/Discriminating Work Demands. This dimension accounted for 13.7% of the variance. It is characterized by job *situations* and activities which require vigilance or attentiveness, and in which the job incumbent must discriminate among various conditions which may occur.

Dimension A6-22: Work Attire. This dimension accounted for 12.4% of the variance, and is characterized by the types of attire the job incumbent must wear on the job. As with dimension A6-18, this dimension is most likely an artifact of the fact that virtually all of the median attribute ratings for these job elements were zero.

Dimension A6-23: Work Schedule II. This dimension accounted for 8.5% of the variance and is almost identical to dimension A6-18. It too is most likely artifactual.

Summary of Dimension Identification Scheme

Each attribute dimension reported in this study was given a unique alphanumeric identifying label in addition to the verbal title. A summary of these labels, the nature of the dimensions, and the data used in the analysis is given in Table 10. An overall listing of all of the dimensions and their titles is given in Table 11.

Table 9

Job Element Dimensions Based on Component Analysis of Job Element Attribute Profiles: PAQ Division 6--Other Job Characteristics

Attribute Dimension		Rotated Loading[a]
Dimension A6-18: Work Schedule I		
165	Irregular hours	94
168	Typical day and night hours	93
167	Typical night hours	90
164	Variable shift work	89
166	Typical day hours	80
163	Regular hours	73
182	Travel	60
161	Regular work	45
Dimension A6-19: Job Responsibility		
185	General responsibility	91
187	Criticality of position	91
186	Job structure	85
180	Updating job knowledge	84
184	Responsibility for material assets	79
179	Working under distractions	58
183	Responsibility for the safety of others	52
Dimension A6-20: Routine/Repetitive Work Activities[b]		
170	Repetitive activities	84
169	Specified work pace	82
171	Cycled work activities	79
172	Following set procedures	64
157	Protective clothing or gear	61
173	Time pressure of situation	57
174	Precision	57
Dimension A6-21: Attentive/Discriminating Work Demands		
177	Vigilance: infrequent events	92
178	Vigilance: continually changing events	90
176	Recognition	90
175	Attention to detail	71
183	Responsibility for the safety of others	61
174	Precision	56
179	Working under distractions	48

Table 9 (cont.)

Attribute Dimension		Rotated Loading[a]
Dimension A6-22: Work Attire		
158	Informal attire	92
159	Apparel style optional	92
155	Specific uniform/apparel	90
154	Business suit or dress	90
182	Travel	58
Dimension A6-23: Work Schedule II		
156	Work clothing	82
161	Regular work	76
162	Irregular work	68
163	Regular hours	57

[a]Loadings below 45 not reported

[b]All job element loadings on this dimension were negative.

Table 10

Summary of Dimension Identification Scheme

Label	Type of Dimension	Nature of Input Data	Table Reference
AG-1 through AG-9	Overall	Attribute medians for 71 attributes and 182 job elements	1
AA-1 through AA-7	Aptitudinal	Attribute medians for 49 aptitudinal attributes and 182 job elements	2
AS-1 through AS-4	Situational	Attribute medians for 22 situational attributes and 182 job elements	3
A1-1 through A1-5	Divisional (PAQ division #1)	Attribute medians for 71 attributes and job elements 1-35	4
A2-6 through A2-7	Divisional (PAQ division #2)	Attribute medians for 71 attributes and job elements 36-49	5
A3-8 through A3-11	Divisional (PAQ division #3)	Attribute medians for 71 attributes and job elements 50-98	6
A4-12 through A4-14	Divisional (PAQ division #4)	Attribute medians for 71 attributes and job elements 99-134	7
A5-15 through A5-17	Divisional (PAQ division #5)	Attribute medians for 71 attributes and job elements 135-153	8
A6-18 through A6-23	Divisional (PAQ division #6)	Attribute medians for 71 attributes and job elements 154-187	9

Table 11

Overall Summary of Job Dimensions

Alphanumeric Label	Verbal Title
AG-1	Cognitive and Interpersonal Skills
AG-2	General Physical Skills
AG-3	Sensory/Judgmental/Memory Demands
AG-4	Visual Discrimination/Perception
AG-5	Quantitative/Technical Demands
AG-6	Psychomotor Skills
AG-7	Aesthetic Judgment/Originality versus Perceptual/Response Demands
AG-8	Chemical Senses
AG-9	Work Pressures/Risks
AA-1	General Physical Skills
AA-2	Cognitive Skills
AA-3	Visual Perception/Interpretation
AA-4	Psychomotor Skills
AA-5	Physical Response/Coordination versus Imaginative Orientation
AA-6	Quantitative Skills
AA-7	Chemical Senses
AS-1	Social/Intellectual Orientation
AS-2	Sensory/Judgmental Demands
AS-3	Structured Work Situations
AS-4	Work Pressures/Risks
A1-1	Visual Input from Devices/Materials
A1-2	Evaluation of Visual Input
A1-3	Perceptual Input from Processes/Events
A1-4	Verbal/Auditory Input/Interpretation
A1-5	Non-Visual Input
A2-6	Use of Job-Related Knowledge
A2-7	Information Processing
A3-8	Manual Control/Coordination Activities
A3-9	Control/Equipment Operation
A3-10	General Body/Handling Activities
A3-11	Use of Foot Controls
A4-12	Interpersonal Communications
A4-13	Signal/Code Communications
A4-14	Serving/Entertaining
A5-15	Unpleasant Physical Environment
A5-16	Personally Demanding Situations
A5-17	Hazardous Physical Environment
A6-18	Work Schedule I
A6-19	Job Responsibility
A6-20	Routine/Repetitive Work Activities
A6-21	Attentive/Discriminating Work Demands
A6-22	Work Attire
A6-23	Work Schedule II

DISCUSSION AND CONCLUSIONS

This study was concerned with the identification of the dimensions underlying the set of attribute data consisting of the median ratings of the relevance of various human attributes to the job elements of the Position Analysis Questionnaire (PAQ) which had been collected earlier by Marquardt and McCormick (1972). Two types of such dimensions were identified. The first consisted of the dimensions underlying the attributes as profiled across the job elements of the PAQ. These dimensions were derived by the use of traditional R-type principal components analyses, in which the resulting dimensions consist of groupings of attributes. The second consisted of the dimensions underlying the various job elements of the PAQ as profiled across the various attributes. These were derived by the use of Q-type principal components analyses, in which the resulting dimensions consist of groupings of job elements.

The results of the first set of analyses consisted of 20 dimensions which are reported in Tables 1 through 3. Overall, these dimensions accounted for a large portion of the variance (79-84%) associated with the data. These dimensions represent groups of human attributes which tend to occur together in various types of job activities. Three sets of such dimensions were identified in this study. The first resulted from a principal components analysis of all of the attributes taken together (9 dimensions); the second resulted from a principal components analysis of the "aptitudinal" attributes (7 dimensions); and the third resulted from a principal components analysis of the "situational" attributes (4 dimensions). In one sense, these dimensions represent groups of human abilities (or requirements to adapt to certain situational demands) which are required for the performance of various job activities. In this regard, one might be tempted to compare these dimensions to those which have been found in various factor analytic studies of human abilities to determine the extent to which such dimensions overlap. In this case, however, such a comparison is not necessarily appropriate. In contrast to a factor analytic study of human abilities, in which it is hypothesized that various abilities are correlated because of some underlying trait, research relating to the attributes as they are judged to be relevant to various job activities would yield dimensions that depend only on the coexistance of various specific attributes in the world of work. Consequently, there is no requirement that the attribute dimensions have psychological meaning similar to the factors of human abilities (Jeanneret and McCormick, 1969). The dimensions reported in this study, therefore, must be viewed in terms of the types of abilities and demands which coexist in jobs, and not in terms of those which coexist in people because each is tied to some common underlying trait. However, it will be noted that certain of the dimensions do tend to parallel some of the factors resulting from factor analyses of human abilities.

The results of the second set of analyses consisted of 23 dimensions which are reported in Tables 4 through 9. Overall, these dimensions also accounted for a large portion of the variance (81-88%) associated with the data. All of the dimensions resulting from these two sets of analyses were interpreted. The dimensions resulted from principal component analyses of the job elements in each of the six PAQ divisions as

profiled across the various attributes. One might then view these dimensions as representing groupings of job activities which tend to occur together because of a similarity in their profiles of judged attribute requirements. It must be remembered with regard to these dimensions that the basis for the grouping of job elements was similarity in their aptitudinal requirements, and not the fact that the activities tend to coexist in various jobs.

The question of the utility of the dimensions reported in this study now appropriately arises. Nothing has been mentioned with regard to this point as yet because the primary emphasis of this study was on the derivation of the dimensions, and not on their use. With regard to the question of the utility of these dimensions, some basic explanation of the rationale underlying the present line of research (which extends beyond the scope of the present study alone) is in order. The basic hypothesis guding this line of research is that there is some order or structure underlying the domain of human work, and that this order or structure might be identified through the use of a systematic job analysis instrument of a worker-oriented type (McCormick, 1959). The PAQ is such an instrument, and therefore provides the basic vehicle being used in the present line of research.

Given this hypothesis, two primary methods of identifying dimensions underlying human work suggest themselves. The first is to use a structured job analysis instrument (such as the PAQ) to analyze each of many jobs, and then to analyze the resulting data in such a manner as to identify the dimensions underlying that data. Such a procedure should serve to identify groups of job activities which tend to occur together in jobs, and which might be viewed as a structure underlying jobs in terms of the activities which are performed or required. The feasibility of using such a procedure has already been demonstrated to some extent by McCormick, Cunningham, and Gordon (1967) and by Jeanneret and McCormick (1969). The second approach would be to determine what human attributes are required for the performance of various job activities, and then to identify the dimensions which underlie such data. These two approaches are not mutually exclusive, nor is it required that they provide the same sets of dimensions due to the fact that they are dealing with the coexistance of (possibly) different types of things (job activities versus the abilities required to perform those activities). It would be surprising, however, to find the dimensions resulting from these two approaches to be mutually contradictory, as in one sense one might argue that if job activities tend to occur together then there should be some degree of comparability of the requirements needed to perform such activities. The second of these approaches was that used in the present study, and it is planned that the first of these approaches will be explored in the future.

The dimensions developed in this study might prove to be of practical utility in a few ways. First, predictions of the types of attributes which are required on a specific job might be made on the basis of a job analysis of the job, and the combining of the job analysis data with the components reported herein to provide dimension scores. Such dimension scores might then give some indication of the

types of abilities a person should have in order to be selected for a given job. Secondly, the use of dimension scores derived from the Q-type dimensions (which group job elements on the basis of similarities of attribute profiles) might be of some utility when jobs are designed. In this regard, it would seem advantageous that jobs be designed in such a manner that the various activities performed require similar abilities (or at least not involve the requirement for abilities that are not likely to be present in the same person). Transfer of training from one job activity to another might thus be facilitated if such considerations are taken into account. Finally, the dimensions reported in this study might be of some utility in the establishment of the validity of personnel tests by indirect means. In this regard, dimension scores obtained from a combination of these dimensions and the actual analysis of a job with the PAQ might serve as possible predictors of aptitude test scores, and prediction equations for predicting test scores and validity coefficients of various personnel tests might be developed. These prediction equations might then provide the basis for predicting what tests would be valid for use as selection devices for given jobs, without the need for conventional test validation procedures. Such a job component validation scheme will be investigated in the future, and it is in part for this reason that the present study was carried out.

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LIST OF ATTRIBUTES

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 quantitative 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 judgment: 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 similarities 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.

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

43. 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 and not deal with the number of responses made.

44. 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.

45. 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.

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

47. 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.

48. 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.

49. 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.

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

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

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

52. 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.

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

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

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

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

57. Influencing people: influencing opinions, attitudes, or judgments about ideas or things.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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