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THE IDENTIFICATION OF COMMON BEHAVIORAL FACTORS AS BASES FOR PRE-ENTRY PREPARATION OF WORKERS FOR GAINFUL EMPLOYMENT. FINAL REPORT.

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THE PURPOSE OF THE STUDY WAS TO DETERMINE WHETHER COMMON BEHAVIORS COULD BE IDENTIFIED ACROSS OCCUPATIONS TO SERVE AS A BASIS FOR CURRICULUM BUILDING. INTERVIEWS WERE CONDUCTED WITH INCUMBENTS IN 47 AGRICULTURAL OCCUPATIONS AND 36 OCCUPATIONS IN THE METAL FABRICATING INDUSTRY FOR A TOTAL OF 466 INTERVIEWS IN COLORADO AND NEBRASKA. THE INTERVIEW SCHEDULE CONTAINED A NUMBER OF GENERAL WORK ENVIRONMENT ITEMS, FOUR CHECKLISTS, AND FIVE MAJOR BEHAVIORAL DIMENSIONS. THE 329 SCORES FOR EACH INTERVIEW WERE SUBJECTED TO FACTOR ANALYSES TO DETERMINE INTERCORRELATIONS AMONG THE OCCUPATIONS. THE ANALYSIS OF THE CORRELATION MATRIX OF THE 47 AGRICULTURE OCCUPATIONS YIELDED THREE OCCUPATIONAL CLUSTERS, PRODUCTION AGRICULTURE, AGRICULTURAL INDUSTRY, AND AGRI-BUSINESS. PRODUCTION AGRICULTURE WAS CHARACTERIZED BY AN AVERAGE OR HIGH LEVEL ON NEARLY ALL OF THE BEHAVIORS, AGRICULTURE INDUSTRY SCORED AT A LOW AVERAGE OR LOW LEVEL, AND AGRI-BUSINESS SCORED AT A GENERALLY HIGH LEVEL EXCEPT FOR LOWS ON THE PHYSICAL AND DISCRIMINATIVE BEHAVIORS. THE ANALYSIS OF THE 36 METAL WORKING OCCUPATIONS ALSO YIELDED THREE CLUSTERS, SKILLED WORKER, SEMISKILLED WORKER, AND BUSINESS. THE BUSINESS CLUSTER IN METAL WORKING EXHIBITED A PATTERN OF SCORES SIMILAR TO THAT OF AGRI-BUSINESS. THE PATTERN OF SCORES ON PRODUCTION AGRICULTURE WAS SUCH THAT A COMPREHENSIVE CURRICULUM IN PRODUCTION AGRICULTURE WOULD COVER THE BEHAVIORS IN THE OTHER CLUSTERS ALSO. THE STUDY RESULTS SUGGESTED THAT A TEAM TEACHING APPROACH WOULD SERVE WELL IN TRAINING FOR PLACEMENT IN AG-INDUSTRY AND AGRI-BUSINESS OCCUPATIONS. (MM)

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September 1967

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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September 1967

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INTRODUCTION

Any agency that is developing and using training programs or vocational curricula is certainly concerned with the program being as efficient and effective as possible. In order to accomplish this, however, the curriculum developer faces a dilemma. Obviously, curricula cannot be developed for every occupation. Two alternatives then seem to be available to the curriculum planner. On the one hand the curriculum can be developed on the basis of certain specific occupations. This kind of curriculum would reasonably be effective and efficient on a short term basis for any individual because the training program would contain only content specific to an occupation with little or no material included that is not essential to the performance of a specific job. When viewed on a long term basis, however, a curriculum designed to train for specific occupations may not be geared to any one occupation, but would teach skills, knowledge and understandings of relevance to a number of similar occupations. This approach would be desirable in the sense that the individual who went through such a program would have the basic skills, knowledge, and understandings for a number of occupations. Furthermore, such training would be especially efficient when the individual is forced to change jobs because it could be expected that the generalized approach would reduce subsequent retraining needs.

The presentation so far indicates that the choice is dichotomous; either a program for specific occupations or a general program in which training is for a number of occupations, but specific to none. That such a dichotomous situation is not necessary or even possible is obvious. A curriculum designed to train for specific occupations will contain activities that allow skills to be developed that are generalizable to other jobs, but their outcome is incidental and not planned. On the other hand, the person who has gone through a training program designed to teach material of relevance to a number of occupations will need additional specific training for any job he may enter. It is difficult to imagine any but the most menial job not requiring some kind of on-the-job training.

On the face of the above description, and at the risk of over simplifying a complex problem, it would appear that the more logical approach to curriculum development in vocational education is the one that teaches the general skills, knowledges, and understandings first as a basis for allowing training in a number of specific jobs. Curricula geared to specific jobs will allow generalizable skills to be taught, but this is likely to be an incidental rather than planned situation. Furthermore, not all of the generalizable material will be relevant to the same jobs with the result that the trainee will have bits and pieces of information of limited applicability to a whole host of jobs rather than a relatively comprehensive and well-integrated background for a number of related jobs.

The basic assumption for the research program that we are pursuing, then, is that vocational curricula designed to teach skills, knowledge, and understandings relevant to a number of jobs followed by specific training for a single job are more efficient and effective than vocational curricula designed to teach certain specific jobs. The central problem of the study reported herein was to determine whether behavioral factors might be identified which would serve as the bases for the development of curricula designed to prepare persons for initial entry into the labor force at the semi-skilled, skilled, or technical levels of employment. The jobs that were studied were limited to the agricultural and metal working industries.

The problem of the study has evolved from the increased emphasis on vocational training and retraining that has occurred in this country in the last few years. Many agencies such as vocational schools, industry, the military, public schools, and unions have considerable responsibility in training persons as competent workers in many occupations. Significant problems are associated with the discharge of this responsibility, not the least of which is the problem of rapid change in occupations resulting from the knowledge explosion and the technological revolution. This rapid change is evidenced not only by the large number of jobs that are becoming obsolete but also by the even larger number of new jobs coming into existence each year.

The purpose of the study reported in this manuscript was to attempt to identify behaviors that are common to a number of occupations. If such behaviors can be identified as common to a number of jobs, then a training curricula which would include training in these behaviors could be developed. The curricula then would provide training so that the participant could have competency in these behaviors which would be applicable to a number of occupations.

It should be clearly recognized by the reader that this study was concentrated primarily on behaviors, and no attempt was made to identify specific knowledges or understandings required in the performance of the jobs. Consequently, any training curriculum based on the common behaviors that were identified in this study would not be sufficient in itself because the specific knowledges and understandings associated with the jobs may be decidedly different. To illustrate this point, consider a farm equipment salesman and a steel products salesman. These two jobs were found to be common in terms of the behaviors required of the incumbent. On the other hand, it is obvious that the specific knowledges and understandings of customer's needs and of the products would be quite different for the two jobs. Consequently, a training course based on the common behaviors identified by this study would not in itself be sufficient for preparing a person to enter either occupation.

The remainder of this report presents information on the development of the instrument, the procedures used in the study, the results, and a discussion of the results.

INSTRUMENT DEVELOPMENT

The first step in the development of the instrument was to review the literature on job analysis, job evaluation, psychomotor behavior, and cognitive behavior. The purposes of this review were to identify job behaviors that have been shown to discriminate among jobs, to become more familiar with methods of measuring job behaviors, and to identify procedures that have been used for clustering jobs. This review of research was written as an interim report for the project (Sjogren and Sahl, 1966). Rather than repeat this review in the final report it was decided to report only the decisions made with respect to the development of the instrument and the sources of support for the decisions.

The results of the various job analysis studies were most relevant for our study. From these studies it appeared that job behaviors could be classified in terms of five major behavioral dimensions; physical, intellectual, discrimination, decision making and responsibility, and communication. The following lists contain some of the factor titles from job analysis studies that we classified under the five major dimensions. The reference is to the study in which the factor title appeared.

I. Physical Behaviors

A. Body agility (McCormick, et al., 1957)

B. Heavy manual work vs. clerical ability (McCormick, et al., 1957

C. Strength (Jaspen, 1949)

D. Manual dexterity (Jaspen, 1949)

E. Mechanical-manual (Orr, 1960)

F. Physical output (Gordon, 1963)

G. Sedentary vs. physical work activity (Palmer and McCormick, 1961)

H. Skilled physical activities (Cunningham and McCormick, 1964; Gordon and McCormick, 1963)

I. Mental vs. physical activities (Cunningham and McCormick, 1964; Gordon and McCormick, 1963)

J. Skilled machine operation (Coombs and Satter, 1949)

II. Intellectual Behaviors

A. Mental and educational development vs. adaptability to routine (McCormick, et al., 1957)

B. Intelligence (Jaspen, 1949)

C. Knowledge of tools vs. mathematics (Palmer and McCormick, 1961)

D. Mediation (Gordon, 1963)

E. Mechanical information (Jaspen, 1949)

F. Mental vs. physical activities (Cunningham and McCormick, 1964; Gordon and McCormick, 1963)

G. Adaptability to precision operations (McCormick, et al., 1957)

H. Manual art ability (McCormick, et al., 1957)

I. Intellectual-supervisory (Orr, 1960)

J. Man-machine control activities (Cunningham and McCormick, 1964; Gordon and McCormick, 1963)

III. Discrimination Behaviors

A. Adaptability to precision operations (McCormick, et al., 1957)

B. Artistic ability and esthetic appreciation (McCormick, et al., 1957)

C. General mechanical activities and inspection (Lawshe and Satter, 1944)

D. Inspection (Jaspen, 1949)

IV. Decision making and responsibility behaviors

A. Diagnostic and analytic activities (Lawshe and Satter, 1944)

B. Self-responsibility (Coombs and Satter, 1949)

C. Intellectual-supervisory (Orr, 1960)

D. Mediation (Gordon, 1963)

E. General decision making and mental activity (Palmer and McCormick, 1961)

F. Decision making and communication (Cunningham and McCormick, 1964; Gordon and McCormick, 1963)

G. Responsible personal contact (Cunningham and McCormick, 1964; Gordon and McCormick, 1963)

V. Communication behaviors

A. Personal contact ability vs. adaptability to routine (McCormick, et al., 1957)

B. Intellectual-supervisory (Orr, 1960)

C. Communications (Gordon, 1963)

D. Communications in business management and information in routine physical work (Palmer and McCormick, 1961)

E. Decision making and communication (Cummingham and McCormick, 1964; Gordon and McCormick, 1963)

F. Hierarchical person-to-person interaction (Cunningham and McCormick, 1964; Gordon and McCormick, 1963)

G. Responsible personal contact (Cunningham and McCormick, 1964; Gordon and McCormick, 1963)

These five major behavioral dimensions were used as the general outline of the instrument developed for the reported study. Each of the dimensions is discussed below in terms of the specific behaviors included for measurement.

Many of the specific physical behaviors that were included in the instrument were physical behavioral factors that had been identified by Fleishman in his studies of psychomotor behavior. (The several references to work by Fleishman and his associates are included in the references list.) Among these specific physical behaviors were finger manipulation, arm-hand manipulation, foot-leg manipulation, general body activity, and motor coordination. We also included under the physical behaviors category, items on motor control operations, object assembly, and hand tool usage. These latter items, which have been used in previous studies, were included to get a measure of more general job behaviors that were expected to be dependent upon the specific psychomotor type behaviors. The three general behaviors were judged to be those that would occur most commonly among the jobs to be studied.

Several of the specific behaviors in the discrimination area also were selected on the basis of the results of the psychomotor studies. Visualization was divided into near and far visualization. Depth discrimination and estimation of speed were included as behaviors involved in spatial relations. Color, sound, odor, taste, and tactual discrimination behaviors were also included along with a blind positioning item. Behaviors involving estimation or inspection and monitoring of work processes were included under the discrimination dimension as general behaviors that would require the exercise of one or more of the specific discrimination behaviors.

The intellectual behaviors included in the instrument were not based on identified cognitive factors. Although cognitive or intellective factors are probably better defined than most other aspects of human behavior, the measurement of most cognitive factors requires the administration of a test, and the amount of testing required was not feasible in the situation of the reported study. Consequently, the intellectual behaviors measured by the instrument were those behaviors included in other job analysis studies. Several general knowledge items were used including knowledge of mathematics, machine operation, machine repair, characteristics of the finished product, characteristics of product components, processes, and business procedures. Verbal behaviors were measured by items on reading, interpretation, and following instructions. Other intellectual behaviors included in the instrument were visualization of relationships, close concentration, and reasoning and problem solving.

The responsibility and decision making behaviors that were included in the instrument were taken from other job analysis studies and were those that seemed most relevant to the jobs to be studied. The behaviors were formulation of policies or goals, making work assignments, forecasting needs, inspection, and ordering and buying.

The communication behaviors were selected on the same basis as the responsibility and decision making behaviors. Communication behaviors included were supervision or training or workers, origination of written communications, communication by other than oral or written means, persuasive communication, and service.

With the specification of the behaviors that were to be measured on the jobs, the next concern was to determine how these behaviors were to be measured. The simplest and perhaps the most reliable measurement would have been to determine whether or not each behavior was exhibited on a job. This type of measurement, however, would not be very discriminating especially when one considers that a certain amount of nearly every behavior is likely present in any human activity. Consequently, it was felt that several aspects of the behavior might be measured and that more precise measurement than dichotomous measurement should be attempted.

The psychomotor studies had reported certain factors of psychomotor behavior that seemed to be dimensions of physical behaviors that might be measured on a continuum. These factors were speed, frequency, precision, and strength. These dimensions were thus used as four measures of each of the physical behaviors. The first three were also used as measures of most of the other behaviors. In addition, the following measures were included on a rational basis as being capable of discriminating among jobs; variety of ways in which the behavior occurred, the importance of the behavior to the job, and the complexity of the behavior.

The first form of the instrument included all of the specific behaviors indicated above. For each behavior a rationally developed four point rating scale was used to measure variety, precision, importance, speed, frequency, and complexity. A four point strength scale was used for the physical behaviors only. Each rating scale contained general statements to define the points. The work of Madden (1960) supported the use of this type of rating scale.

Beside the behaviors the instrument also called for responses on items relevant to the job as a whole and a check list of activities performed on the job. These were included in an attempt to get at certain job characteristics that might be related to the behavioral factors, especially job environment factors. The check lists also included many clerical, physical, and communication behaviors. The inclusion of these items was to achieve enough redundancy to allow for every significant factor to emerge in the analysis.

Thirty interviews were conducted by the investigators with the first form of the instrument. This tryout revealed the following information about the instrument:

1. A judgment of the variety of the behavior by the incumbent was difficult with a rating scale. A more reasonable response was obtained by asking the incumbent to name the ways in which they performed the behavior. A count of the ways provided a measure of variety.

2. A general precision scale was not meaningful, and it seemed that separate scales were needed for each of the following areas; mathematics usage, application of knowledge, interpretation, physical movements, and discrimination.

3. The importance of the behavior to successful performance of the job was difficult to measure because the incumbent seemed to consider anything he did to be important. There was some variance on this scale, however, which indicated some discriminatory power, and the scale was retained in the final form of the instrument.

4. The speed and strength scales as written were responded to quite meaningfully when appropriate and seemed to discriminate.

5. Frequency was difficult to scale. Several versions of a frequency scale were tried and the version in the final form seemed to allow for meaningful and discriminatory responses.

6. Complexity of the behavior was also difficult to scale. The incumbents seemed to have difficulty understanding what was meant by the scale. It was finally decided to post-code this item on the basis of a judgment from the responses to the ways the behavior was shown on the job.

7. The general job items, the clerical behavior items, and the checklists seemed to allow for meaningful responses.

8. Not all scales were appropriate for all of the items.

On the basis of the results of the first tryout interviews, the instrument was revised and the second revision was tried out with another thirty interviews. In the second try-out the interviews were conducted by some of the persons who were hired as interviewers. For the second tryout the instrument was as it is in the final form except for the frequency scale. The frequency item was left as an open-ended item for the second tryout and an attempt was made to post-code the responses. The responses were so varied that this type of coding was nearly impossible. Consequently, the frequency scale was finally structured as shown in the instrument in Appendix A. The rating scales were shortened to three or four point scales for the second tryout because the interviewees in the first tryout tended to use only three or four points. The points used were usually the extremes and the mid-point.

Table 1 contains the behaviors that were included in the final form of the instrument and an indication of the scales used to measure each behavior. The complete instrument is included as Appendix A of this report.

Many decisions were made about the instrument as it was developed, and it is likely that not all of the judgments were the best possible. Had some other investigators developed the instrument, it is probable that the content, the format, and the scaling procedures would not have been the same. The judgments that were made during this stage of the project influenced the obtained results. The point of this paragraph is to emphasize one limitation of the reported study. The limitation is that the decisions made during the instrumentation phase determined what was to be measured and how it was to be measured. The results of the project then reflect these judgments. Had different decisions been made regarding the instrument, the results of the project might not have been the same. We felt our decisions were reasonable and based on the available evidence, but we do recognize and want to acknowledge this limitation of the study resulting from our instrumentation judgments.

Instrument Reliability

The interviews of the second tryout were used to obtain an estimate of the reliability of the instrument. Ideally reliability should have been obtained on the basis of two administrations of the interview with a job incumbent. This method was not practical in the present situation, however, because of the difficulty in being able to conduct two interviews, each taking 1½ to 2 hours, with the same person.

The reliability data were obtained then by conducting interviews with two people with the same job title during the second tryout of the instrument. The thirty interviews of the second tryout were conducted with two incumbents from each of the following jobs: farm machinery salesman, general farmer, welder, farm equipment serviceman, steel worker, secretary, farm and ranch salesman, sheet metal worker, shipper, crane operator, fertilizer salesman, and clerical workers. Four interviews were conducted with punch press operators and farmers. The reliability estimate was obtained by correlating the responses for each job with every other job. It was expected that the jobs with the same titles would correlate more highly with each other than with other job titles, and this

Table 1

Outline of Behaviors Included in the Instrument and the Scales Used to Measure Each Behavior

	Variety	Precision	Importance	Speed	Frequency	Strength	Complexity
A. Physical Behavior							
1. Finger manipulation	x	x	x	x	x	x	x
2. Arm-hand manipulation	x	x	x	x	x	x	x
3. Foot-leg manipulation	x	x	x	x	x	x	x
4. Motor coordination	x	x	x	x	x	x	x
5. General body activity	x	x	x	x	x	x	x
6. Motor control	x	x	x	x	x	x	x
7. Object assembly	x	x	x	x	x	x	x
8. Hand tools	x	x	x		x	x	x
B. Discrimination Behavior							
1. Near visual	x	x	x	x	x		x
2. Far visual	x	x	x	x	x		x
3. Depth	x	x	x	x	x		x
4. Speed estimation	x	x	x	x	x		x
5. Estimation of quality and quantity	x	x	x	x	x		x
6. Color	x	x	x	x	x		x
7. Sound	x	x	x	x	x		x
8. Odor	x	x	x		x		x
9. Taste	x	x	x		x		x
10. Factual	x	x	x		x		x
11. Blind positioning	x	x	x	x	x		x
12. Monitoring	x	x	x	x	x		x
C. Intellectual Behavior							
1. Math usage	x	x	x	x	x		x
2. Machine operation	x	x	x		x		x
3. Machine repair	x	x	x		x		x
4. Finished product	x	x	x		x		x
5. Materials	x	x	x		x		x
6. Processes	x	x	x		x		x
7. Business procedures	x	x	x		x		x
8. Read and interpret	x	x	x		x		x
9. Receive instructions	x	x			x		x
10. Visualize relationships	x		x		x		x
11. Close concentration	x		x		x		x
12. Reasoning	x		x	x	x		x

Table 1
(continued)

	Variety	Precision	Importance	Speed	Frequency	Strength	Complexity
D. Responsibility and Decision Making							
1. Formulate policies and goals	x	x	x		x		
2. Make work assignments	x	x			x		x
3. Forecast needs	x	x	x		x		x
4. Inspection	x	x	x		x		x
5. Ordering	x	x	x		x		x
E. Communication Behavior							
1. Supervise or train	x	x	x		x		x
2. Originate written comm.	x	x	x		x		x
3. Comm. other than oral or written	x		x		x		x
4. Persuasive comm.	x		x		x		x
5. Service	x		x	x	x		x

higher correlation would indicate reliability of the instrument. The interviews of the second tryou were conducted by four different interviewers.

The correlations in Table 2 are the correlations between the job titles, the highest correlation that each job had with another, and the lowest correlation. Although no standard was available for judging whether the instrument was reliable, the data in Table 2 did support a conclusion that it did have adequate reliability. Fifteen of the jobs were correlated highest with jobs with the same title, and for the other fifteen jobs their highest correlation was with a job that seemed to be quite similar. Furthermore, the lowest correlation of each job with another was in each instance with a job that would be expected to have a low correlation. The magnitude of the correlations indicating reliability was not exceptionally high, but two factors beside instrument error served to reduce the correlations. First, the correlations are based on interviews with two different incumbents with the same job title. It is well known that the specific nature of the work of two persons with the same job title will differ. This difference would serve to reduce the correlation between the jobs. Secondly, the interviewers were different for the interviews and any interviewer differences would tend to reduce the correlations between jobs. This last factor, of course, is an error factor in the interview procedure, but not an error factor of the instrument itself.

On the basis of the data in Table 2, it was decided that the instrument was of satisfactory reliability for the study. It was mentioned earlier in this report that the only change made in the instrument from the second tryout to the final form was to structure the frequency scale. No tryout was made of the final form of the frequency scale, but our impression is that the structure used for the scale served to make this scale more reliable in the final form than it was in the second tryout where free responses were post-coded.

Table 2

Correlation for Reliability Estimate

Job	Correlation with same job title	Job	Highest Corre- lation	Job	Lowest Corre- lation
1. Punch Press	.64	Punch Press	.64	Farm Sales	.10
2. Punch Press	.51	Farm Service	.57	Farm Sales	.04
3. Punch Press	.70	Punch Press	.70	Farm Sales	.02
4. Punch Press	.70	Punch Press	.70	Farm Sales	.03
5. Farmer	.65	Farmer	.65	Crane Operator	.03
6. Farmer	.66	Farmer	.66	Crane Operator	.05
7. Farmer	.65	Farmer	.65	Crane Operator	.09
8. Farmer	.66	Farmer	.66	Crane Operator	.09
9. Farm Mach. Sales	.40	Farm Service	.62	Crane Operator	.03
10. Farm Mach. Sales	.40	Welder	.54	Secretary	.21
11. Welder	.38	Farm Service	.62	Crane Operator	.13
12. Welder	.38	Punch Press	.49	Farm Sales	.01
13. Farm Mach. Ser.	.54	Farm Mach. Sales	.62	Shipper	.13
14. Farm Mach. Ser.	.54	Welder	.62	Farm Sales	.10
15. Steel Worker	.42	Punch Press	.50	Farm Sales	.01
16. Steel Worker	.42	Sheet Metal	.53	Crane Operator	.19
17. Secretary	.47	Secretary	.47	Farmer	.08
18. Secretary	.47	Clerical	.63	Punch Press	.12
19. Farm Sales	.60	Farm Sales	.60	Crane Operator	.00
20. Farm Sales	.60	Farm Sales	.60	Shipper	.01
21. Sheet Metal	.57	Punch Press	.64	Farmer	.12
22. Sheet Metal	.57	Punch Press	.61	Farm Sales	.12
23. Shipper	.54	Sheet Metal	.68	Farm Sales	.00
24. Shipper	.54	Shipper	.54	Farmer	.10
25. Crane Operator	.80	Crane Operator	.80	Farm Sales	.01
26. Crane Operator	.80	Crane Operator	.80	Farm Sales	.00
27. Fertilizer Sales	.57	Farmer	.62	Farm Sales	.19
28. Fertilizer Sales	.57	Fertilizer Sales	.57	Farm Sales	.05
29. Clerical	.62	Clerical	.62	Crane Operator	.09
30. Clerical	.62	Secretary	.63	Crane Operator	.15

PROCEDURE

The data of the project were collected by interviewing job incumbents. The incumbents were workers at the semi-skilled, skilled, and technical levels in the agriculture and metal-working industries. Agricultural occupations were defined as consisting of occupations in either of the following categories: production agriculture occupations, those industries that deal directly with production agriculture in buying, selling, or servicing agricultural products and equipment, or those industries concerned with raising or tending plants or animals. The metal working occupations were in those industries that process or fabricate metal products.

It was originally intended to draw a sample of 100 agricultural workers and 100 metal workers from the states of Colorado and Nebraska. Ten workers were to be drawn randomly from each industry in each of 10 counties selected randomly. A second sample was also to be drawn which would consist of 10 workers in each of 20 selected occupations.

It soon became obvious that the sampling procedures were not feasible. The major difficulty was that the interviewee had to consent to be interviewed and with refusals the random selection procedure was not operable. A second source of difficulty was related to the first. The pool of available workers in some counties was quite small, and with refusals, this pool was depleted without obtaining a sufficient number of interviews.

As a consequence of these problems, it was decided to change the sampling procedures. A list of occupations at the semi-skilled, skilled, and technical levels was developed for the agricultural and metal-working industries as defined for the project. The list was developed using the Dictionary of Occupational Titles and in consultation with personnel from the Department of Labor. Table 3 contains the titles of the 50 agricultural and 34 metal-working occupations that were selected.

The departure from the original sampling procedure seemed justifiable on the basis of the purposes of the project. The project

Table 3

Titles of Occupations Selected for Study

Metal Industry	Agriculture Industry	
Machinist	Poultry broiler	Farmer, dryland--grain
Tool and die makers	Poultry egg	Farmer, irrigated--grain
Punch press operator	Poultry turkey	Dryland, livestock and grain
Welder	Hog	Irrigated, livestock and grain
Brake operator	Cattle feeding	Fruit production farmer
Lathe operator	Cattle ranching	Artificial breeding technician
Blacksmith	Dairy farmer	Greenhouse workers
Forgemen	Truck farmer	Feed and seed salesmen
Hammerman	Custom operator	Fertilizer salesmen
Foundry workers	Gardeners	Mechanics (mech. and set up men)
Clerical	Greenskeepers	Grain elevator man
Truck drivers	Flower growers	Yardman (lumber yard)
Stock man	Nursery man	Rodman surveying
Forklift drivers	Feed mixers	Buyer (hog and cattle)
Crane operator	Truck drivers	Chopper operator
Pattern makers	Implement salesmen	Heavy equipment operator
Salesman	Partsmen	Bulk petroleum salesmen
Painters (factory)	Soils tester	Yardman (sales barn)
Siding installer	Veterinarian aid	Dairy plant worker
Purchasing agent	Ranch hand	Alfalfa dehy. plant worker
Boilermakers	Farm hand	Food processing worker
Molders	Auctioneer	Irrigation ditch tender
Metal fabricators	Dairy herdsman	Sheep ranching
Milling machine operator	Hatchery worker	
Sheet metal workers (factory)	Brand inspector	
Sheet metal workers (construction)	Tree trimmer	
Heat treaters and annealors	Clerical	
Steel workers (metal building const.)		
Metal assembly workers		
Inspectors (metal manufacturing)		
Drill press operator (single spindle)		
Drill press operator (multi spindle)		
Shear machine operator (non automatic)		
Grinders, buffers and filers		

was designed to identify common behaviors among occupations. Consequently, it did not seem necessary that the occupations be sampled randomly. Rather the necessary consideration was more that the sample consist of those jobs that were existent in the industry. In fact a random sampling procedure in the agricultural industry would have likely resulted in a heavy concentration of workers in production agriculture and the representation of agriculturally related jobs would have been inadequate.

Interviews with five incumbents in each of the 84 occupations were conducted. The incumbents were selected from various areas of each of the two states. The incumbents' names were obtained by going to industries in the states and asking to interview employees. Farmers' names were obtained from county extension offices. In order to establish that the incumbent was qualified for his occupation, only employees who had been on the job for six months and who were considered by their employer to be satisfactory were interviewed.

With the change in selection of incumbents, it was decided not to conduct the second phase of the study separately. The purpose of the second phase was to obtain job scores on each variable in the interview schedule by using the mean of the 10 jobs on that variable. The sampling procedure used enabled us to do this on each job except that the mean score was based in most cases on fewer than 10 jobs.

Five interviews for each of 84 jobs would have resulted in 420 interviews. A total of 466 interviews were conducted, however. The additional interviews were required because of the fact that the same job title for two people does not necessarily mean they are doing the same thing. When the interviews were reviewed, even though a particular job title was indicated for an incumbent, it was apparent that the job of the person better fit another title under the DOT description.

Table 4 contains the job titles of the incumbents who were interviewed and the number of interviews for each title.

It is apparent from Table 4 that several jobs were covered by more than five interviews and five were not attained in many cases. The decision to stop interviewing was made at this point because of

Table 4

Occupations Interviewed with Number of Interviews per Occupation

Agriculture	No. of Interviews	Metal	No. of Interviews
General farm	15	Welder	15
Mechanic	12	Sheet metal	14
Sales, farm equipment	12	Machinest	14
Nursery	10	Assembler	14
Secretary and clerical	10	Lathe operator	13
Cattle ranch	9	Tool and die	12
Grain elevator	9	Drill press	11
Farm hand	8	Clerk	10
Feed sales	8	Painter	10
Ranch hand	8	Punch press	9
Feed mill	7	Brake operator	6
Truck driver	7	Crane operator	6
Grain farmer	6	Inspector	6
Sales, fertilizer	6	Metal fabricator	6
Flower grower	6	Pattern maker	6
Tractor operator (heavy equipment)	6	Forklift	5
Poultry farm	5	Truck driver	5
Fruit farm	5	Stockman	5
Sales, petroleum	5	Heat treater	5
Partsman	5	Secretary	5
Vegetable farm	5	Molder	5
Dairy farm	4	Purchasing agent	5
Cattle feed	4	Sales, building	4
Soil tester	4	Milling machine operator	4
Pellet mill operator	4	Mechanic	4
Artificial breeding technician	4	Shear machine operator	4
Groundskeeper	4	Miscellaneous foreman	4
Soil conservation	4	Grinder	4
Food process	3	Sales, equipment	3
Lumber yard	3	Blacksmith	3
Herdsman	3	Welder (machine)	3
Buyer	3	Boilermaker	2
Chopper operator	3	Metal pourer	2
Veterinarian aid	3	Drop hammer	1
Ditch rider	3	Packager	1
Sheep grower	3	Cupolatender	1
Custom operator	3		
Golf course superintendent	2		
Hog grower	2		
Tree trimmer	2		
Ag. technician	2		
Sale barn yardman	2		
Greenskeeper	2		
Brand inspector	2		
Cannery worker	2		
Auctioneer	2		
Hatchery worker	2		

the fact that the sources of interviewees was virtually exhausted for the remaining jobs and the time schedule for the project was being violated.

Of the 466 interviews, 221 were conducted in Colorado and 245 in Nebraska. More metal worker interviews were conducted in Nebraska, because of the larger population of metal workers. To compensate a larger number of agricultural worker interviews were conducted in Colorado. Of the 277 metal-working interviews, 153 were done in Nebraska and 74 in Colorado. On the other hand, 147 agricultural worker interviews were done in Colorado and 92 in Nebraska for a total of 239.

Interviewers

The 24 interviewers used in this study were men and women between the ages of 20 and 60, all of whom were either students or housewives. The student group was composed of four graduate students in vocational education and psychology and eight undergraduate students, seven of whom were seniors and one of which was a junior. The undergraduates were majoring in such fields as psychology, pharmachology, agricultural education and economics. Seven of the housewives were high school graduates, and the remaining five had some college experience.

All interviewers were given a three-day training program in which an attempt was made to give them familiarization and experience with the structured interview they were to later use. During the training program the interviewers were also exposed to basic and pertinent interviewing principles so as to develop a sound basis for comparability between interviewers.

After the data were collected 238 interviews were drawn at random. It was then determined which interviewer had done each of the randomly selected interviews. A requirement for retaining an interviewer in this segment of our comparability study was that in the random sample there had to be at least one metal and one agricultural interview from that interviewer. Using this criterion interviewers 1, 2, 3, 4, 5, 7, 10, 11, 12, 13, 16, 17, 18, 21 and 23 were retained in the comparability study and yielded a total of 213 interviews. A summation score was computed for each interview based on sections P, D, I, R, and C of the interview. These data were then entered in Table 5. In this table the score for each interview is listed under the appropriate interviewer number, and in terms of whether a given interview was in the metal industry (M) or in the field of agriculture (A). From this table one can readily see that for 12 out of the 15 interviewers the sum and mean scores for the agricultural interviews were higher than the sum and mean scores for the metal interviews. (For two of the interviews for whom this was not the case, interviewers 12 and 21, there was only one interview available in a given area and therefore a true mean was not obtained. Should more interviews have been available for these two interviewers, it is postulated that their results would be in agreement with the other 12 previously mentioned interviewers).

Further indication of comparability between interviewers is obtained when the sums and means for all the interviews are combined. When this is done, a sum of 28,526 is obtained for the metal interviews, with a mean of 246, as opposed to a sum of 35,370 for the agricultural interviews, with a mean of 290.

The Interview

The job incumbents were interviewed either at their place of work or at their home. The interview session generally lasted from one and one-half to two hours.

In conducting the interview, the interviewer had a copy of the instrument and the scale descriptions. The incumbent also had a copy of the scale descriptions. The interviewer would read the item and ask the incumbent to respond. If the incumbent responded that he did not use a particular behavior the interviewer would proceed to the next item. If the incumbent indicated he did use a behavior on the job, the interviewer would have him indicate the ways in which he performed this behavior. The interviewer would write these down. The interviewer and the incumbent would then respond to the scales listed under that behavior. The incumbent was asked to give a rating and at the same time the interviewer would make a judgment as to the appropriate rating on the basis of what the incumbent had said about the behavior. If the two ratings agreed, the interviewer went on to the next scale, but if they disagreed the interviewer and incumbent would discuss the rating and attempt to come to an agreement of the appropriate rating. If agreement could not be reached quickly, the interviewer would proceed to the next scale and make a notation of the disagreement on the instrument. Final decisions on the unresolved ratings were made by the project director. There were few such cases, however.

Table 5

Totals per Interview by Interviewer for Metal and Agriculture

1		2		3		4		5		7		10		11		
M	A	M	A	M	A	M	A	M	A	M	A	M	A	M	A	
166	330	210	254	292	290	120	345	266	407	235	396	137	288	400	284	
281	242	271	355	420	392		524	325	315	212	340	231	496	240		
312		273	423	458	318		340	222	421	356	398	317		255		
302		155	431	214	348		246		285	370	363	379		195		
		182	466	187	203		550		297	375	310	334		260		
		310	453	468	164				619	241	274	239		237		
		255	264	258	506				580		279	251		344		
		141	473	404	323				589		503	331		318		
			420		425				584		520	200		185		
			309		140						401	270		193		
			382		563						269	326		242		
			422		297						539	259		141		
			567		465						627	130		244		
			344		165						528	191		305		
			269		274						268	128		145		
			301		261						259	144		422		
			369								267	182		176		
			370									230		196		
			220									151		274		
			580									300		220		
			282									233		209		
			254									117		188		
			137									141		169		
			208									151		208		
												201		203		
												220		144		
												149		384		
												291		123		
												367		150		
												247				
1061	572	1797	8553	2701	5134	120	2005	813	4097	1789	6541	6847	784	6770	284	ΣX
265	286	225	356	338	321	120	401	271	455	298	385	228	392	233	284	$\overline{X}$

Table 5
(continued)

12		13		16		17		18		21		23		
M	A	M	A	M	A	M	A	M	A	M	A	M	A	
324	290	195	265	278	284	346	370	251	440	358	297	154	437	
371			401	174	270	234	326	283	535		218		472	
238			423	147	290		371	197	594		112		199	
295				226			338	311	468					
210				138				151						
421				141				187						
				307				247						
								246						
								198						
1859	290	195	1089	1411	844	580	1405	2071	2037	358	627	154	1108	ΣX
310	290	195	363	202	281	290	351	230	509	358	209	154	369	$\bar{X}$

Sum for metal = 28,526

Grand mean for metal = 246

Sum for ag = 35,370

Grand mean for ag = 290

The complexity scale was post coded by one person, a graduate student in industrial psychology. The rating was made on the basis of the description of the behavior on the instrument. The project director and the research associate each reviewed 50 of the schedules and generally agreed with the ratings made on the complexity scale. One rater was used in order to eliminate inter-rater differences. When the research associate rated the schedules independently, he agreed with the rater on 88 per cent of the ratings.

Several analyses were made of the data and are presented in the next chapter of this report.

RESULTS

For each interview there were 313 separate scores from the interview schedule. The scores were 0 or 1 on those variables which were responded to with a yes or no or on a checklist. The scores on the scales were as follows: 0-9 for variety, 0-3 for precision, 0-7 for frequency, 0-4 for importance, 0-3 for speed, 0-4 for strength, and 0-4 for complexity. Worker trait data from the appropriate worker trait group in the third edition of the DOT were also recorded for each interview. The DOT data included the following 44 scores: the three values in the DOT representing involvement of the job with people, data, and things, the GED score, the SVP score, the eleven aptitude scores, the ten interests scored as 0 or 1 if they were mentioned with the worker trait group or not, the twelve temperaments scored as the interests were scored, and seven physical demands scores. The total number of scores for each job then was 357.

Frequency distributions were made for each of the 357 variables in order to determine which behaviors or characteristics occurred so seldom or often that they would serve no useful purpose in the ensuing analyses. If a behavior or characteristic was marked on fewer or more than ten per cent of the schedules, that item was dropped. A total of 28 items were dropped from subsequent consideration on this basis. The dropped items are listed below:

A. Fewer than 10 per cent responded that they had received special vocational training in high school, apprentice training, or been enrolled in junior college. (three scores dropped)

B. The regularity of the job item did not discriminate. More than 90 per cent of the incumbents indicated their employment was continuous. (four scores dropped)

C. Fewer than 10 per cent responded that taste discrimination behavior was part of their job. (four scores dropped)

D. Few persons took shorthand or operated bookkeeping machines. (two scores dropped)

E. There was little personal contact with investors or suppliers (two scores dropped)

F. Few persons were paid by the piece, contract, commission, tips, or some other means. (five scores dropped)

G. Fewer than 10 per cent wore ties or uniforms. (two scores dropped)

H. Interests 4, 5, and 8 and temperaments 6, 8, and 11 from the DOT occurred less than 10 per cent of the time for the jobs included in the study. (six scores dropped)

The analyses of the data then were based on 329 scores for each job consisting of 291 scores from the interview schedule and 38 scores from the DOT worker trait groups.

The Analyses

Factor analysis was used as the basic analysis tool of the project. Various matrices were factor analyzed by the principal axis procedure and the ensuing factor matrices were rotated with the varimax procedure. Basically two types of matrices were developed for analyses, a correlation matrix and a difference matrix. The difference matrix seemed to be an extension of the use of the D statistic of Orr (1960). This matrix will be explained in detail in a later section of this report.

Two approaches to the identification of common behaviors among occupations by factor analysis were considered. In one approach correlations could be computed among the 329 variables and the ensuing matrix analyzed and the factor matrix rotated. The factor scores of each of the occupations on each of the factors could then be computed. Those occupations with high scores on a factor could be considered to have that behavior in common that was defined by the variables with high loadings on that factor.

The other approach would be to correlate occupations. A factor analysis and rotation of this matrix would result in factors that would be defined by occupations that exhibited commonality. Each factor would in effect be an occupational cluster. It would be possible to identify the behaviors that caused the occupations to cluster by referring to the data matrix and observing the pattern of scores of the occupation in the cluster on the 329 variables.

The latter approach was chosen for a very practical reason. Even with high speed, large capacity computers, a 329 x 329 matrix presents a formidable computational and storage problem. The programs and computers available to us could not handle a correlation matrix larger than 220 x 220. Consequently, the procedure described first above was not used except that the correlations among all of the variables were obtained. These correlations among the variables are discussed next.

The intercorrelation matrix of all of the measures contained different kinds of correlations depending on the type of measurement. The correlations between dichotomously scored variables were phi coefficients, whereas the correlations between dichotomously scored variables and those scored on a continuum were point-biserial correlations. The correlations between variables scored on a continuum were product moment correlations. All, of course, were estimates of the product moment correlations if the assumptions for the product moment had been met.

A 329 x 329 variable correlation matrix is so large, unwieldy, and difficult to read that it did not seem desirable to try to include it in the report. An examination of the correlations in the matrix indicated that the five general dimensions of behavior were meaningful categories for grouping job behaviors. The dimensions were physical, discrimination, intellectual, decision making and responsibility, and communication behaviors. Generally the correlations among the items within a behavior category were higher than the correlations among items across behavior categories.

The correlations between the scales on a single item in the five behavior category sets were spurious because they were not independent. On a single item, either all of the scales would have a score or none would have a score. This lack of independence would tend to raise the correlations. When these correlations were not considered, the generally higher correlation within behavior categories than across categories were still observed.

Three factor analyses were done with smaller matrices than the complete matrix. An analysis was made of each of two 100 x 100 correlation matrices and the third analysis was of a 125 x 125 matrix. Each analysis was a principal axis solution and the obtained factors were rotated to the varimax criterion. Unity was used as the communality estimate for all matrices.

The 100 x 100 matrices were correlation matrices of two sets of 100 of the 329 variables selected at random. In both instances the 100 variables were selected from the total number of 329. One limitation of the two factor analyses is that not all of the correlations were independent. The random selection procedure resulted in some of the selected variables being two or more of the scales within a behavior item. The spurious correlation between such variables would be expected to cause these variables to exhibit commonality (i.e., form a factor) and this in fact did occur. Such factors are not entirely artificial, however, but it is not possible to determine the extent to which they were formed by the measurement bias.

Another limitation of the analyses derives from the fact that the selected variables were a sample and the obtained factor structure of an analysis is the common factor structure of the specific variables. Consequently, the obtained factor structures should be considered to be only suggestive of the common behaviors measured by the 329 variables.

With these limitations in mind, we still believed that the analyses provided useful information about the factor structure of the instrument used in the study. Generally the analyses supported the intuitive decision we had made to structure the instrument according to the five behavioral dimensions named earlier in this report.

The factors obtained in the analysis of the first set of variables are presented in Table 6.

Only those variables with loadings of .40 or greater were included in the table. The percentage figure is the per cent of variance of the correlation matrix that is explained by the factor. Fifteen factors were extracted from the 100 x 100 correlation matrix. The fifteen factors were then rotated to the varimax criterion. The fifteen factors accounted for 57.6 per cent of the total variance in the original matrix. An examination of the characteristic roots of the fifteen factors suggested that there was a small amount of common variance remaining in the matrix and that a few more than fifteen factors should have been extracted. The root of the fifteenth factor was 1.646. Kaiser (1960) has suggested that factors with roots greater than unity are accounting for a significant portion of the common variance. It would have been desirable, then, to have extracted as many factors as needed so that the last factor would have had a root of less than unity. The fifteen factors that were obtained, however, did account for most of the significant common variance of the variables in the correlation matrix.

The first factor which accounted for 14.6 per cent of the variance was interpreted as a supervisory factor. The variables with high loadings on this factor generally were variables dealing with behaviors at a management or supervisory level. The factor also suggested a job level interpretation. The high negative loading for Temperament Y on this factor indicated that the occupations

Table 6

Factor Loadings of Variables after Rotation on First Set of 100 Randomly Selected Variables*

Item Number	Factor I (14.6%)	Loading
R3G	Develop Budget--Complexity	79
I7B	Know Business Proc.--Precision	77
R5D	Buying and Ordering--Importance	71
R3A	Develop Budget--Variety	73
G3,36	Self-employed	70
I7C	Know Business Proc.--Frequency	70
G3,10	Make Major Decisions	68
R3C	Develop Budget--Frequency	67
7	Supervision	67
DOT	Temperament Y	-65
R1C	Form Policy--Frequency	64
DOT	Interest 7	61
I6C	Know Processes--Complexity	61
C4G	Persuasive Communica.--Complexity	60
D5G	Estimate Quality,etc.--Complexity	60
C4D	Persuasive Commun.--Importance	60
G1F	Bookkeeping Done	59
I4A	Know Charac. of Prod.--Variety	54
I8G	Read and Interpret--Complexity	54
D2G	Far Visual Discrim.--Complexity	54
I6D	Know Processes--Importance	52
C2G	Written Communication--Complexity	51
G2J	Contact with Employees	49
R4A	Inspection--Variety	48
C2C	Written Communic.--Frequency	48
C5G	Personal Service--Complexity	48

Item Number	Factor I (continued)	Loading
D5A	Estimate Quality, etc.--Variety	47
I12C	Reasoning--Frequency	46
G1G	Take Inventory	46
D2D	Far Visual Discrimination--Importance	44
I12D	Reasoning--Importance	44
D2C	Far Visual Discrimination--Frequency	43
D5D	Estimate Quality, etc.--Importance	41
C5E	Personal Service--Speed	40
D6G	Color Discrimination--Complexity	40
	Factor II (5.5%)	
DOT	Special Vocational Preparation	-87
DOT	Temperament 2	84
DOT	Aptitude N	84
DOT	GED score	-84
DOT	Interest 3	82
DOT	Aptitude V	68
	Factor III (4.8%)	
P5F	General Body Activity--Strength	75
P5E	General Body Activity--Speed	69
G3,23	Lifting	65
P7F	Assembly--Strength	59
P8G	Hand Tools--Complexity	57

Table 6
(continued)

Item Number	Factor III (continued)	Loading
P7E	Assembly--Speed	56
G3,26	Pushing	55
G3,22	Reaching	44
G3,13	Running	43
	Factor IV (4.2%)	
DOT	Temperament 5	-79
DOT	Fifth Digit--People	70
DOT	Interest 2	-69
DOT	Interest 1	61
DOT	Physical Demand 3	57
DOT	Interest 7	44
C5E	Personal Service--Speed	-44
C4D	Persuasive Commun.--Importance	-43
C4G	Persuasive Commun.--Complexity	-41
	Factor V (3.9%)	
P4E	Simultaneous Coord.--Speed	62
P4G	Simultaneous Coord.--Complexity	61
P6E	Motor Control--Speed	56
P6F	Motor Control--Strength	56
P6D	Motor Control--Importance	55
P4F	Simultaneous Coord.--Strength	54
P2B	Arm-Hand Movement--Precision	52
I2G	Machine Operation--Complexity	43
I2D	Machine Operation--Importance	41

Item Number	Factor VI (3.5%)	Loading
D4D	Estimate Speed--Importance	70
D4B	Estimate Speed--Precision	67
D2D	Far Visual Discrimination--Importance	58
D2G	Far Visual Discrimination--Complexity	55
C3A	Hand Signals--Variety	49
	Factor VII (3.5%)	
D1D	Near Visual Discrimination--Importance	83
D1B	Near Visual Discrimination--Precision	82
D1G	Near Visual Discrimination--Complexity	70
D1A	Near Visual Discrimination--Variety	67
	Factor VIII (3.2%)	
D6D	Color Discrimination--Importance	84
D6E	Color Discrimination--Speed	80
D6G	Color Discrimination--Complexity	76
D6C	Color Discrimination--Frequency	67
	Factor IX (2.5%)	
P1B	Finger Movements--Precision	74
P1F	Finger Movements--Strength	72
P1A	Finger Movements--Variety	70

Table 6
(continued)

Item Number	Factor X (2.3%)	Loading
G32	Monitor Work of Others	41
C2C	Written Communication--Frequency	40
	Factor XI (2.2%)	
D12B	Monitoring--Precision	76
D12G	Monitoring--Complexity	71
D7E	Sound Discrimination--Speed	43
	Factor XII (2.1%)	
I2D	Know Machine Operation--Importance	53
I2G	Know Machine Operation--Complexity	45
	Factor XIII (2.0%)	
D5D	Estimate Quality, etc.--Importance	59
D5A	Estimate Quality, etc.--Variety	55
D5G	Estimate Quality, etc.--Complexity	49

*The variables listed on each factor in this and subsequent tables are only those with loadings of .40 or greater unless otherwise indicated. The decimal point is omitted to save space.

with high scores on the other variables loading on this factor did not show a requirement for Temperament Y in their respective worker trait group descriptions in the DOT. Occupations with low scores on the remaining variables did tend to have a requirement for Temperament Y mentioned in the worker trait group descriptions. Temperament Y is a temperament required to adjust to situations involving precise attainment of set limits, tolerances, or standards. The outcome is reasonable in that supervisory temperament is more one that requires adjustment to ambiguous situations than well-defined situations. The behavioral scales that loaded on this factor were primarily from items dealing with intellectual, responsibility and decision making, and communication behaviors.

Factor II had high loadings only on various scores from DOT worker trait group characteristics. The factor was interpreted as a mental ability factor in that high loadings were on variables of training and aptitude. The Interest 3 and Temperament 2 variables are interest in and adjustment to repetitive situations. The negative loadings were a function of scale direction. Numerical and verbal ability scores, general educational development scores, and specific vocational preparation scores in the worker trait groups were related in the expected direction and the scores tended to be negatively related to interest in or a requirement to be able to adjust to situations of a repetitive or routine nature.

The physical behavior items came out as three separate factors. Factor III was interpreted as a general physical activity factor, factor V was an obvious physical coordination factor, and factor IX consisted of the scales in the analysis from the finger movements item.

Discrimination behaviors defined five of the factors. Factor VI was a far visual discrimination factor. The variables with high loadings on this factor were suggestive of some of the behaviors of a truck driver. The other discrimination factors, VII, VIII, XI and XIII, were each specific to the scales of one discrimination item. Thus, there was a near visual discrimination, color discrimination, monitoring, and an estimation of quality, quantity, or size factor.

Factor IV was interpreted as a bi-polar factor of dealing with people vs. dealing with things. Although the factor was defined primarily by DOT information, three communication behaviors did load on the factor.

Factors X, XII, XIV, and XV were either doublets or had only one variable with a loading greater than .40.

Thus, the analysis of the first set of 100 variables resulted in several distinct physical and discrimination behavior factors. The intellectual, responsibility and decision making, and communication behaviors loaded togather on one factor, except for one other factor on which some communication behaviors had small loadings.

The results of the factor analysis of the second set of 100 variables are presented in Table 7. Twenty factors were extracted and rotated in this analysis because of the fact that the fifteen factors in the first analysis had probably not accounted for all of the significant common variance. The 20 factors in the second analysis apparently did not account for all of the common variance. The root of the 20th factor was 1.58 which fact suggested that additional common variance could have been explained with a few more factors. The 20 factors accounted for 61.5 per cent of the variance in the correlation matrix.

The first factor in this analysis was very similar to the first factor in the other analysis. Many of the intellective, responsibility and decision making, and communication variables loaded on this factor. The factor was interpreted as a supervisory or occupational level factor.

In contrast with the first analysis, however, the second analysis yielded other factors in the intellective and communication behavior areas. Factor VI was called a knowledge of machine operation factor and factor XIII (a doublet) was considered as a behavior requiring visualization of relationships. The scales with loadings on these factors were from items in the intellective dimension. Factor VII was interpreted as a personal service or customer contact factor (communicative behavior). Factor XVI also had a communication behavior aspect, but its nature was difficult to interpret.

Physical behaviors emerged as five distinct factors. Factor IV was called a general physical factor and factor VIII also involved rather general physical behaviors. Factor IX (a doublet) was interpreted as an assembly factor and factors X and XI were respectively labeled finger movement and coordination.

Discrimination behaviors were present in four factors. Factor III was clearly a far visual discrimination factor and factor XII

Table 7

Factor Loadings of Variables after Rotation on Second Set of 100 Randomly Selected Variables

Item Number	Factor I (11.0%)	Loading
R3D	Develop Budget--Importance	75
R4G	Inspection--Complexity	72
R5D	Buy or Order--Importance	72
I7A	Know Business Procedures--Variety	70
R1B	Form Policy--Precision	69
R5B	Buy or Order--Precision	68
I7B	Know Business Proced.--Precision	68
R4B	Inspection--Precision	67
DOT	Fourth Digit--Data	-61
I12G	Reasoning--Complexity	60
R4C	Inspection--Frequency	57
D5G	Estimate Quality, etc.--Complexity	56
R1C	Form Policy--Frequency	55
C4D	Persuasive Communication--Importance	55
C1D	Speak to Others--Importance	53
I6C	Know Processes--Precision	51
I8D	Read and Interpret--Importance	51
I11G	Close Concentration--Complexity	50
I7C	Know Business Proced.--Frequency	50
G31	Supervise Others	49
DOT	N Score	-46
DOT	Temperament 5	42
I11A	Close Concentration--Variety	41

Item Number	Factor II (4.3%)	Loading
D12C	Monitoring--Frequency	58
P8C	Hand Tools--Frequency	54
I3C	Know Machine Assembly--Frequency	53
I12C	Reasoning--Frequency	53
P1D	Finger Movements--Importance	51
D3C	Depth Discrimination--Frequency	45
I4C	Know about Product--Frequency	45

Item Number	Factor III (3.8%)	Loading
D2E	Far Visualization--Speed	78
D2B	Far Visualization--Precision	74
D2A	Far Visualization--Variety	68
D2C	Far Visualization--Frequency	62
P3B	Foot-Leg Movement--Precision	46
DOT	Aptitude E	-45

Item Number	Factor IV (3.3%)	Loading
P5C	General Body Activity--Frequency	80
P56	General Body Activity--Complexity	77
P8F	Hand Tools--Strength	45
P8D	Hand Tools--Importance	45
G3,41	Wear Work Clothes	44

Item Number	Factor V (3.3%)	Loading
DOT	Physical Demand 4	-71
DOT	Interest 6	69
DOT	Temperament 5	66
DOT	Fifth Digit--People	-53
DOT	Aptitude E	44

Item Number	Factor VI (3.1%)	Loading
I2D	Know Machine Operation--Importance	80
I2B	Know Machine Operation--Precision	78
I2G	Know Machine Operation--Complexity	69
P4E	Simultaneous Coordination--Speed	41

Table 7
(continued)

Item Number	Factor VII (3.1%)	Loading
C5E	Personal Service--Speed	69
C5G	Personal Service--Complexity	68
G2G	Contact with Customers	52
G1I	Receptionist Duties	46
	Factor VIII (2.9%)	
G3,25	Throwing	61
G3,13	Running	60
C3A	Hand Signals--Variety	51
C3G	Hand Signals--Complexity	48
G3,20	Kneeling	46
	Factor IX (2.8%)	
P7E	Assembly--Speed	76
P7B	Assembly--Precision	74
	Factor X (2.5%)	
P1E	Finger Movement--Speed	80
P1F	Finger Movement--Strength	75
P1B	Finger Movement--Precision	66
P1D	Finger Movement--Importance	43

Item Number	Factor XI (2.5%)	Loading
P4E	Simultaneous Coordination--Speed	60
P5A	General Body Activity--Variety	60
P4F	Simultaneous Coordination--Strength	56
P4B	Simultaneous Coordination--Precision	48
DOT	Aptitude K	-46
	Factor XII (2.4%)	
D6G	Color Discrimination--Complexity	71
D6C	Color Discrimination--Frequency	69
D6E	Color Discrimination--Speed	64
	Factor XIII (2.3%)	
I10G	Visualize Relationships--Complexity	79
I10A	Visualize Relationships--Variety	77
	Factor XIV (2.3%)	
D1E	Near Visual Discrimination--Speed	73
D1B	Near Visual Discrimination--Precision	68
I1E	Mathematics Usage--Speed	50
	Factor XV (2.3%)	
D8G	Odor Discrimination--Complexity	55
D8A	Odor Discrimination--Variety	53
D7D	Sound Discrimination--Importance	52

Table 7
(continued)

Item Number	Factor XVI (2.1%)	Loading
P8D	Hand Tools--Importance	44
G2K	Contact with Trainees	43
C1D	Speak to Others--Importance	43
P8F	Hand Tools--Strength	42
G3,30	Regular Salary	40
	Factor XVII (2.0%)	
DOT	Physical Demand 5	-63
DOT	Aptitude IV	62
DOT	Fourth Digit--Data	52
DOT	Fifth Digit--People	45
	Factor XVIII (2.0%)	
No loading of .40		
	Factor XIX (1.8%)	
G2C	Contact with non-supervisors	59
	Factor XX (1.5%)	
P2F	Arm-Hand Movement--Strength	73
P2C	Arm-Hand Movement--Frequency	42

had loadings on the color discrimination scales. Factors XIV and XV were interpreted respectively as near visual discrimination and odor discrimination.

Two factors emerged from the DOT scores, factors V and XVII. Factor V appeared to be a people vs. things interest factor and factor XVII was interpreted as an ability factor.

Factor II was difficult to interpret although it accounted for a considerable portion of the variance. Many variables had loadings above .30 on this factor but few were over .40, and no variables had the high loadings that were observed on other factors. There was a suggestion that the factor might reflect a level of machine operation kind of behavior and it was given this tentative interpretation.

Factors XVIII, XIX, and XX each had only one variable with a loading greater than .40.

We felt the two analyses yielded generally consistent results, and the results were supportive of our considering occupational behaviors along five major behavioral dimensions.

A third factor analysis of the instrument was made. In this analysis all of the scores were independent of each other. The 41 items under the five behaviors were each assigned a single score rather than as many scores as there were scales in that item. The single score for each interview was the average of the scale scores for the item. This procedure reduced the number of variables from 329 to 147. The 147 x 147 correlation matrix was obtained.

The available principal axis factor analysis program could not treat this large a matrix, however, so the matrix was reduced to size 125 x 125. This reduction was accomplished by dropping the interest, temperament, and physical demands scores from the DOT. There were 22 such scores.

The 125 x 125 correlation matrix was factor analyzed and the ensuing factor matrix rotated to the varimax criterion. Twenty factors, which accounted for 59.5 per cent of the variance of the matrix, were extracted. The root of the twentieth factor was 1.45 which indicated that not all of the significant common variance in the matrix was extracted. The 20 factors are presented in Table 8 with those variables with loadings greater than .40. Many of the twenty factors are doublets so that it would appear that the twenty factors were sufficient to extract the interpretable commonality of the matrix.

Table 8

Rotated Factors from Analysis of 125 x 125 Correlation Matrix of 109 Independent Instrument Items and 16 DOT Scores

Item Number	Factor I (12.5%)	Loading	Item Number	Factor II (5.4%)	Loading
G3,3	Hiring Responsibility	82	DOT	Numerical Aptitude	85
G3,4	Dismissal Responsibility	83	DOT	Special Vocational Preparation	-82
G3,5	Makes Changes in Status	78	DOT	General Educational Development	-81
R3	Develops Budget	77	DOT	Spatial Aptitude	79
R1	Formulates Policy	73	DOT	Form Perception	77
I7	Knows Business Procedures	72	DOT	Data	71
G3,6	Makes Work Schedules	72	DOT	Finger Dexterity	67
R5	Buys and Orders	70	DOT	Verbal Aptitude	64
G3,10	Makes Major Decisions	69	DOT	Intelligence	63
G3,36	Self-Employed	67	DOT	Things	59
G3,8	Regulates Work of Others	66	DOT	Clerical Aptitude	57
7	Supervision Level	64	DOT	Manual Dexterity	54
R2	Makes Work Assignments	63	DOT	Motor Coordination	44
G3,31	Hourly Pay	-62			
G2,M	Contact with Suppliers	61			
G3,1	Supervises Others	60		**Factor III (5.3%)**	
G2,J	Contact with Perspective Employees	60			
R4	Inspects for Quality, etc.	60	D11	Blind Positioning	68
I4	Knows Characteristics of Products	58	P4	Simultaneous Coordination	67
C1	Speaks to Others	57	P6	Motor Control Operations	66
G3,2	Monitors Work of Others	51	P3	Foot-Leg Movements	64
DOT-C	Color Discrimination Aptitude	-50	D3	Depth Discrimination	56
I6	Knows Processes	50	D4	Estimate Speed	55
I12	Reasoning and Problem Solving	50	I2	Know Machine Operation	54
C4	Persuasive Communications	48	P2	Arm-Hand Movements	54
D5	Estimate Quality, etc.	47	D7	Sound Discrimination	53
G2,E	Contact with Salesmen	47	P8	Use of Hand Tools	46
I5	Knows About Materials	45	D2	Far Visual Discrimination	46
DOT	Data (scale is reversed)	-44	I3	Knows Machine Assembly	41
C2	Originates Written Communication	44	P7	Assembles Objects	41
I8	Reads and Interprets	43	D8	Odor Discrimination	41
G1,F	Does Bookkeeping	41			
I1	Uses Mathematics	41			
G3,9	Responsible for Other's Safety	41			

Table 8
(continued)

Item Number	Factor IV (5.2%)	Loading
G3,24	Carrying	78
G3,18	Stooping	75
G3,23	Lifting	73
G3,22	Reaching	66
G3,28	Handling	65
G3,20	Kneeling	63
G3,19	Crouching	62
G3,27	Pulling	61
G3,26	Pushing	60
G3,17	Standing	59
P5	General Bodily Activity	45
G3,15	Climbing	44
P8	Use Hand Tools	43
P2	Arm-Hand Movement	42
G3,14	Balancing	40

Item Number	Factor V (3.9%)	Loading
G1,D	Operates Calculator, etc.	71
G1,B	Types	70
G1,A	Files	70
G1,I	Receptionist	63
G1,F	Bookkeeping	62
G1,G	Takes Inventory	54
G1,H	Operates Duplicating Machine	43
G1,J	Other Clerical Duties	41

Item Number	Factor VI (3.2%)	Loading
G3,12	Jumping	71
G3,16	Crawling	63
G3,13	Running	62
G3,25	Throwing	58
C3	Gives Hand Signals	48
G3,14	Balancing	44
G3,15	Climbing	41

Item Number	Factor VII (2.5%)	Loading
G2,C	Contact with Non-supervisory Employees	58
G2,F	Contact with Semi-professional, etc.	42
G2,D	Contact with Clerical Employees	41
G2,A	Contact with Management	41
G3,2	Monitors Work of Others	40

Item Number	Factor VIII (2.4%)	Loading
I1	Use of Mathematics	52
D1	Near Visual Discrimination	47
I10	Visualization	47
I8	Read and Interpret	46
I9	Follow Instructions	41
I11	Close Concentration	40

Table 8
(continued)

Item Number	Factor IX (2.0%)	Loading
12	Unusual Work Environment	-82
11	Uncomfortable Working Conditions	72
10	Physical Hazards in Work	65
	Factor X (2.0%)	
G3,21	Sitting	48
G1,H	Operates Duplicating Machines	45
G3,41	Wear Work Clothes	-41
	Factor XI (1.9%)	
P1	Finger Movements	53
G3,29	Fingering	47
	Factor XII (1.8%)	
G3,30	Salaried	74
G2,A	Contact with Management	45
	Factor XIII (1.7%)	
DOT	Motor Coordination	53
DOT	Finger Manipulation	52
DOT	Form Perception	45
DOT	Manual Dexterity	44
	Factor XIV (1.6%)	
G2,M	Contact with Suppliers	48
G2,E	Contact with Salesmen	42

Item Number	Factor XV (1.5%)	Loading
1	Less than High School Education	-79
2	High School Education	78
	Factor XVI (1.5%)	
G3,38	Optional Dress	51
	Factor XVII (1.4%)	
6	Other Education	62
C5	Provides Personal Service	40
	Factor XVIII (1.3%)	
14	Special Visual Conditions	54
3	Vocational after High School	44
	Factor XIX (1.3%)	
G21	Contact with Important Persons	46
	Factor XX (1.2%)	
4	On-job-training	52

The results of the analysis as presented in Table 8 were generally consistent with the results of the previous two analyses. The first factor was again a supervisory or occupational level factor. A factor composed of the DOT scores emerged and was interpreted as an ability factor. The negative loadings were a function of scale direction. Factor XIII was also made up of certain DOT scores on dexterity and perception items.

Factor III was interpreted as physical-discrimination behavior factor that is likely closely associated with behaviors employed in machine operations.

Factor IV was interpreted as a general body activity factor with a strength connotation. Factor VI was also considered to be a physical factor with emphasis on the use of the limbs or coordination.

A clear clerical factor emerged as Factor V. Factor VII appeared to be a personal contact type of behavior and Factor VIII was interpreted as a factor reflecting behaviors associated with close work.

Factor IX was a work environment factor with an expected pattern of loadings.

Factor X had low loadings and might be reflecting a certain discrimination between clerical and blue-collar occupations.

The remaining factors were doublets and not interpreted although the double loadings in most appeared reasonable.

The three factor analyses of the instrument did indicate the instrument was measuring behaviors that discriminated among occupations in a meaningful manner. The five dimensions that were used on an a priori basis for the development of the instrument did not emerge as clearly seperable factors. The physical behaviors formed distinguishable clusters as did the discrimination behaviors to a lesser degree. The intellectual, responsibility and decision making, and communication behaviors tended to cluster together. This outcome would be expected, however, because each of these kinds of behaviors are cognitive in nature.

It was interesting, and somewhat disappointing to us, that the items in the instrument did not cluster well with scores from the DOT. We were hopeful that such clustering would occur as this would have indicated a type of concurrent validity for the instruemnt items. Apparently the items in the instrument were measuring behaviors different from the behaviors specified by the scores from the DOT worker trait groups. Although the instrument was not perfectly reliable, the fact that the analyses yielded several rather clearly defined factors supported the assumption that reliable and valid measurement of job behaviors was achieved.

Occupational Clusters and Common Behaviors

As indicated in the procedures chapter the approach taken for identification of common behaviors was to identify occupational clusters and then determine those behaviors that characterized the occupations in the cluster. The occupational clusters were identified by applying a factor analysis procedure. The identification of behaviors was accomplished by determining the scoring pattern of the occupations in a cluster on the 329 variables.

The occupational clustering was done with a principal factor analysis and varimax rotation procedure. The analyses were conducted on two different types of matrices derived from the raw data. One matrix was a correlation matrix of the correlations between occupations. This analysis was an application of the "Q" technique of analysis (Guilford, 1954). The other matrix was based on the difference scores between the occupations on each variable.

The first step in the clustering procedure was to compute mean scores for each occupational title on each of the 329 variables. The mean scores were then used to obtain the correlation matrix and the difference matrix.

Analysis of 47 Occupational Titles in Agriculture

After the mean score on each variable for each of the 47 agricultural occupations had been computed, the occupations were correlated with each other. The 47 x 47 correlation matrix is presented in Table 9.

Table 9

Correlation Coefficients Between 47 Agricultural Occupations
(The jobs are ordered the same as the list in Table 4)

1.																													
2.	74																												
3.	61	62																											
4.	69	75	77																										
5.	51	62	78	80																									
6.	91	73	70	72	55																								
7.	67	79	76	90	82	71																							
8.	65	79	55	73	49	65	75																						
9.	61	61	90	81	85	67	80	49																					
10.	59	80	56	75	54	59	76	92	50																				
11.	55	77	60	79	64	56	83	81	61	84																			
12.	47	67	57	71	55	50	75	80	55	81	74																		
13.	83	70	62	65	50	84	65	64	57	57	54	49																	
14.	67	63	78	77	70	67	75	59	79	58	67	50	64																
15.	67	58	60	72	66	70	71	41	70	37	52	39	66	62															
16.	70	73	68	73	58	75	75	75	61	72	64	77	73	63	58														
17.	77	63	62	67	56	82	69	55	61	49	56	45	79	67	75	66													
18.	80	56	58	66	46	84	60	55	57	46	44	40	80	63	67	64	80												
19.	54	55	82	77	75	61	77	54	84	60	60	61	53	73	59	66	55	50											
20.	45	48	79	68	79	53	72	35	85	39	54	40	44	67	61	45	54	40	75										
21.	84	67	63	74	58	87	69	58	64	52	52	46	82	66	78	70	33	84	57	49									
22.	81	69	59	65	48	82	64	61	54	58	54	49	80	63	62	66	77	78	52	42	77								
23.	83	65	67	67	52	85	69	57	64	52	52	47	78	63	72	66	82	80	59	52	82	78							
24.	59	71	60	72	73	64	72	53	68	52	55	56	52	55	66	62	61	53	56	57	64	54	56						
25.	43	68	56	70	63	45	78	78	54	78	86	77	43	54	42	59	43	31	54	48	41	47	43	51					
26.	47	59	59	64	67	53	67	47	66	53	55	56	46	51	60	56	54	45	66	60	55	52	51	64	50				
27.	58	72	56	75	56	61	77	81	54	80	73	77	59	58	52	73	53	57	58	41	61	58	56	58	74	51			
28.	52	54	61	70	60	60	64	58	65	58	52	60	54	55	52	62	56	58	60	55	61	45	56	65	47	54	57		
29.	52	74	57	74	60	54	60	78	58	78	82	74	52	59	48	69	50	39	60	53	50	46	51	57	77	51	73	58	
30.	51	72	68	80	64	54	79	77	64	80	75	78	52	64	44	68	47	44	67	56	51	50	47	61	73	61	77	63	69

Table 9
(continued)

31.	75	75	61	67	60	72	75	60	66	58	59	56	60	55	60	63	60	54	56	55	60	61	66	67	53
	53	58	51	56	59																				
32.	53	50	74	70	65	56	66	41	76	42	49	51	48	65	54	55	55	53	60	63	55	46	55	59	39
	48	45	63	45	59	57																			
33.	40	70	47	65	49	45	69	82	40	85	80	81	50	47	35	69	43	30	51	34	41	43	36	47	81
	50	79	51	78	75	47	37																		
34.	50	62	66	79	76	56	80	60	70	61	70	63	53	66	68	66	64	50	69	67	61	55	52	69	65
	70	66	59	67	67	53	55	63																	
35.	54	66	63	72	55	65	73	76	56	72	67	67	61	61	53	77	62	61	63	45	64	60	56	57	58
	54	75	60	65	69	42	49	69	53																
36.	70	58	63	67	62	77	69	48	66	44	47	45	68	57	72	62	77	71	60	61	73	68	75	64	42
	57	52	54	46	51	63	58	37	62	51															
37.	73	73	67	76	59	70	78	75	60	71	67	71	67	64	55	83	66	57	67	49	66	62	66	55	61
	51	66	49	71	66	67	50	64	67	66	59														
38.	69	52	63	61	47	72	61	53	60	50	55	49	60	59	54	66	62	62	52	51	62	61	65	46	50
	39	52	49	48	46	56	51	42	51	53	55	59													
39.	71	58	60	56	45	77	60	51	55	44	48	41	79	58	63	63	79	75	47	48	69	71	77	51	37
	38	51	49	46	45	53	49	36	49	53	72	57	58												
40.	42	67	44	63	45	43	68	79	38	83	72	76	44	42	32	65	38	33	51	30	36	40	40	44	69
	43	79	49	76	75	50	36	83	53	62	36	64	37	39											
41.	52	60	56	75	56	74	68	72	52	71	63	64	54	58	44	64	50	58	56	42	59	54	50	57	61
	47	76	58	57	70	50	49	64	61	69	47	59	49	49	61										
42.	42	56	58	76	62	48	74	66	57	69	66	69	48	57	45	63	48	48	65	48	49	47	41	54	60
	62	67	60	61	73	48	49	64	69	70	50	59	37	41	62	70									
43.	64	71	56	68	49	66	65	74	52	70	62	60	68	59	43	65	56	66	46	39	59	66	54	50	54
	44	70	48	53	67	57	49	60	51	62	53	63	52	56	58	69	61								
44.	40	55	59	69	59	49	74	59	59	63	63	72	45	50	49	61	41	36	69	57	47	45	43	51	64
	67	62	57	63	68	50	45	63	67	65	48	58	37	37	59	54	71	47							
45.	41	60	49	69	57	44	71	76	51	74	75	73	38	53	43	61	46	38	50	40	45	40	42	55	79
	48	70	58	76	65	48	45	76	65	63	46	58	45	36	67	64	63	48	56						
46.	41	39	73	62	67	47	60	33	71	37	44	43	39	62	48	44	44	45	62	62	47	45	50	46	42
	53	39	55	34	49	42	63	33	52	42	51	41	46	40	27	45	56	44	47	38					
47.	49	62	57	76	64	55	73	63	58	67	69	61	46	63	51	60	52	46	61	56	51	47	40	58	65
	53	69	57	66	74	48	48	65	71	63	50	58	47	43	61	68	69	52	60	62	43				

The correlations in the matrix are somewhat spurious because of the auto-correlation between scales within an item. This auto-correlation could serve to either cause an over or under estimate of the true correlation. Despite this limitation, however, a factor analysis of the matrix would be expected to yield factors that would consist of occupational clusters. The loadings in the factor matrix should probably not be interpreted as correlations, but rather as simply an indication of having some behaviors in common with the other occupations with loadings on the factor.

Twenty factors were extracted from the correlation matrix with the principal axis solution. Unity was used as the communality estimate for this solution and all subsequent analyses reported. The 20 factors accounted for 93.6 per cent of the variance in the correlation matrix. An examination of the roots of the 20 factors indicated that five of the factors had roots greater than unity and were thus accounting for most of the significant common variance. Factors six and seven had roots near unity so it was decided to rotate the seven factors with the varimax procedure. Table 10 contains the factors obtained after rotation that had two or more occupations with loadings greater than .40.

Three rather clear occupational clusters were evident in the factors. Factor I was interpreted as a production agriculture factor. The occupations with the eleven highest loadings on this factor were all some type of production agriculture occupation. Factor II was interpreted as occupations in agriculture industry. Nearly all of the occupations in this cluster were wage-earning occupations in some type of agriculture related industry. It was interesting to note that farm and ranch hands loaded much stronger on this factor than on Factor I. Factor III was identified as an agri-business factor with a heavy emphasis on sales. Most of the occupations in this cluster involved some sort of contact with other people. Factor IV was a doublet and explained a much smaller portion of the common variance than the other three. The three factors that emerged from the rotation accounted for 72.1 per cent of the variance in the original matrix.

Another matrix, which we called a difference matrix, was constructed and subjected to factor analysis. There were three reasons for trying this procedure. The first reason was to reduce the

Table 10

Significant Factors from Varimax Rotation of Factor Analysis of Matrix in Table 9

Factor I (30.4%)		Factor II (23.9%)		Factor III (17.8%)		Factor IV (3.5%)	
Cattle rancher	89	Chopper operator	88	Sales, feed	80	Artificial Breeding Technician	57
General farmer	88	Tree trimmer	84	Partsman	80	Brand inspector	54
Fruit farmer	88	Ranch hand	84	Sales, equipment	75		
Cattle feeder	86	Farm hand	82	Secretary & Clerical	73		
Grain farmer	86	Truck driver	76	Auctioneer	72		
Vegetable farmer	85	Pellet mill worker	75	Sales, petroleum	69		
Poultry farmer	84	Groundskeeper	74	Buyer	65		
Dairy farmer	82	Food processing wk.	72	Sales, fertilizer	60		
Hog grower	81	Feed mill worker	71	Elevator worker	55		
Sheep grower	73	Cannery worker	71	Nursery worker	55		
Flower grower	68	Lumber yard man	67	Veterinarian aid	49		
Golf course supt.	65	Mechanic	60	Lumber yard man	48		
Tractor operator	61	Ag. technician	60	Brand inspector	44		
Herdsman	60	Ditch rider	59	Groundskeeper	44		
Mechanic	58	Sale barn yardman	57	Feed mill worker	42		
Custom operator	58	Tractor operator	55	Pellet mill worker	42		
Greenskeeper	57	Hatchery worker	55	Soil conserv. tech.	42		
Sales, fertilizer	56	Greenskeeper	53	Hatchery worker	41		
Sales, equipment	53	Custom operator	53				
Nursery worker	53	Elevator worker	53				
Elevator worker	51	Brand inspector	52				
Sales, feed	50	Nursery worker	49				
Soil tester	50	Veterinarian aid	42				
Ditch rider	48						
Livestock buyer	46						
Farm hand	46						
Soil conserv. tech.	43						
Groundskeeper	43						
Ag. technician	41						
Sales, petroleum	40						

influence of the auto-correlation caused by the lack of independence between scales within an item. The second was that the "Q" technique of factor analysis is most appropriate with ipsative measurement and our measures were not ipsative. The third reason was that the correlations between occupations were not influenced by level. Two occupations could correlate very highly on the 329 scores but still differ considerably in terms of level. This last reason is actually a reflection of the fact that the measures were not ipsative.

Orr (1960) has reported a technique for occupational clustering based on a D statistic and the hierarchical grouping procedure used by the Air Force (Marsh, 1965) seemed to be based on a like statistic. The D statistic is obtained by computing the difference score between occupations on each variable and squaring and summing the differences across the variables. The magnitude of the D value is thus a direct measure of the degree of similarity between occupations.

A factor analysis of a matrix of D values among occupations should be expected to yield clusters of occupations. Further the D matrix would be less influenced by the auto-correlation between the scales and would reflect differences in scoring level on the variables.

The D values among the 47 agricultural occupations were obtained. The maximum possible D score on the 329 variables was 7,679 and the minimum was, of course, zero. The largest D value among the 47 occupations was 1,113 which was between fruit farmer and chopper operator. The smallest D value, 68, was between farm equipment salesman and feed salesman.

The D matrix could not be analyzed with our program because it had zeroes in the diagonals. Consequently, the matrix was transformed as follows:

$$D' = \frac{D}{Big} \quad \text{and}$$

$$D'' = 1.00 - D'$$

where D" is the matrix used in the analysis. The D matrix was first divided by the scaler "Big" which was the largest D value in the matrix to yield a D' matrix. The D' matrix was subtracted from the scaler of 1.00 to yield the D" matrix which is shown in Table 11.

Table 11

Difference Matrix Between 47 Agriculture Occupations
(Order same as Table 4)

1.																													
2.	68																												
3.	60	76																											
4.	68	84	86																										
5.	36	71	83	82																									
6.	92	76	75	77	53																								
7.	58	87	86	93	88	71																							
8.	56	85	68	80	61	66	82																						
9.	59	77	94	89	88	72	89	66																					
10.	52	85	69	82	64	62	83	94	67																				
11.	41	82	71	82	74	54	89	85	74	85																			
12.	35	76	69	77	67	51	83	84	70	85	81																		
13.	80	74	69	71	51	85	69	66	66	61	55	52																	
14.	67	76	86	86	75	75	83	70	87	70	73	62	71																
15.	59	73	76	82	76	72	84	59	83	57	67	59	70	75															
16.	65	83	81	84	70	78	85	82	78	81	75	83	77	77	75														
17.	71	74	75	78	66	82	79	66	75	62	66	58	82	77	83	77													
18.	78	50	53	62	30	83	50	45	52	37	29	26	77	60	57	58	73												
19.	56	71	89	86	80	70	86	67	91	71	70	71	63	83	74	79	70	48											
20.	35	62	84	75	85	54	81	50	89	53	66	56	47	74	74	62	65	28	80										
21.	84	74	73	81	59	90	74	64	73	60	56	51	85	76	80	77	85	82	69	54									
22.	82	73	68	72	49	86	68	64	65	62	54	51	82	72	67	72	80	76	63	46	82								
23.	83	73	75	76	55	89	73	63	73	60	55	52	81	73	76	74	85	78	70	57	86	83							
24.	42	78	71	77	81	59	82	64	78	64	69	69	53	65	77	74	70	35	68	70	63	53	58						
25.	20	71	63	71	70	36	82	79	64	79	88	81	38	58	56	66	50	07	60	58	39	40	40	63					
26.	33	70	70	76	77	51	79	59	77	64	68	69	49	63	73	69	65	29	74	71	57	51	55	76	62				
27.	41	77	65	78	66	56	82	84	66	83	79	81	57	64	64	78	61	40	66	53	60	55	56	68	77	62			
28.	43	70	75	80	73	61	80	71	80	71	69	74	59	70	72	77	69	46	74	70	66	52	62	78	61	71	69		
29.	36	80	68	78	71	51	86	82	71	82	87	81	52	67	64	77	61	23	69	65	52	47	53	70	82	65	78	72	
30.	39	78	75	83	72	53	85	81	74	84	80	83	53	71	61	76	58	30	74	66	55	51	52	71	76	70	81	74	76

Table 11
(continued)

31.	72	81	73	77	65	77	81	68	76	67	65	63	66	69	71	74	70	51	69	63	69	68	74	70
	54	60	62	63	62	64																		
32.	45	61	79	76	70	58	74	51	81	52	57	59	51	72	65	66	63	43	69	69	60	50	60	66
	45	57	52	71	54	65	64																	
33.	10	69	54	64	59	31	74	80	53	82	83	83	36	50	50	70	48	00	55	46	34	31	30	60
	84	62	80	63	82	77	46	40																
34.	40	72	76	83	82	56	86	69	80	70	77	73	56	73	78	76	72	37	77	75	64	56	57	77
	70	78	71	72	75	74	62	62	67															
35.	38	73	71	76	64	59	80	79	68	77	74	74	59	67	65	81	68	44	70	56	62	57	56	67
	64	65	79	71	72	74	55	55	72	72														
36.	70	72	76	79	68	82	79	62	79	59	59	58	74	73	80	76	84	68	75	69	81	75	82	70
	48	65	59	68	57	60	74	66	40	70	59													
37.	74	74	70	78	55	76	74	73	65	70	62	65	70	70	59	82	68	56	71	48	72	68	72	51
	49	48	59	51	63	61	71	50	45	63	57	67												
38.	69	50	61	60	35	74	54	47	57	44	42	38	58	59	49	62	59	58	52	40	64	63	67	33
	29	28	38	42	35	35	55	44	15	41	39	57	60											
39.	64	60	63	59	43	75	61	51	59	44	46	40	78	61	63	65	78	68	52	46	69	70	77	48
	29	37	46	50	43	43	55	47	23	48	49	73	55	51										
40.	25	72	55	68	56	40	75	81	53	85	77	80	42	51	48	71	47	13	59	43	38	38	41	56
	73	55	82	62	80	79	54	42	84	61	67	45	55	21	33									
41.	39	58	55	71	50	52	63	68	51	66	57	58	48	56	43	61	48	44	54	37	55	48	47	50
	50	41	69	54	50	64	47	43	49	55	62	46	52	36	39	52								
42.	18	57	59	72	62	36	73	64	59	68	65	68	39	55	48	63	47	24	64	49	42	37	34	56
	58	62	66	62	61	72	45	47	61	68	69	49	46	14	27	60	60							
43.	57	72	60	70	47	65	66	73	57	70	60	58	67	63	48	67	59	57	52	39	60	65	56	49
	46	43	66	50	51	64	59	48	48	51	58	57	61	44	51	53	62	52						
44.	27	63	67	73	66	47	79	65	68	68	69	77	44	58	60	69	50	20	74	64	48	44	46	61
	67	73	67	67	69	72	55	50	64	72	69	56	53	25	32	63	46	69	43					
45.	17	65	58	69	66	35	77	77	62	75	80	78	34	57	56	67	52	13	57	53	41	33	39	67
	83	60	74	69	81	70	50	49	81	70	68	50	44	23	27	71	52	61	40	60				
46.	35	57	81	73	75	51	75	49	81	53	59	58	45	72	65	62	58	34	73	72	54	50	57	62
	53	56	52	70	51	61	55	70	45	64	54	63	43	38	41	40	41	56	45	56	50			
47.	35	66	63	77	67	51	76	66	65	70	71	65	44	67	59	66	57	30	65	61	51	45	41	63
	65	58	70	64	69	76	52	50	63	73	64	55	52	34	37	62	61	65	48	61	62	50		

The values in the matrix thus are like a per cent of agreement between occupations. A value of 1.00 indicates maximum agreement and a value of 0.00 indicates least agreement among the occupations in the matrix.

Twenty factors were extracted from the D" matrix with the principal axis solution. The 20 factors accounted for 95.6 per cent of the variance of the matrix. Seven factors, which accounted for 86.1 per cent of the variance were rotated to the varimax criterion. The results of the rotation are presented in Table 12.

It is apparent that the analysis of the D" matrix yielded results very similar to the analysis of the correlation matrix. Three factors accounted for 75.8 per cent of the total variance and a fourth factor accounted for a very small portion of the variance. The three strong factors are nearly identical to the three factors that emerged in the analysis of the correlation matrix.

Thus the two analyses are mutually supportive and indicate that the 47 agricultural occupations in the analyses represent three occupational clusters. There was a distinct production agriculture business cluster. In the next section these clusters will be compared in terms of the behaviors that characterize a cluster and differentiate among the clusters.

Common Behaviors in Agriculture Occupation Clusters

Table 13 contains data that are indicative of the behavior characteristics of an occupational cluster. The first three columns are of the agriculture occupation clusters. Columns four, five, and six are data on the three clusters identified in the analysis of the metal working occupations. A description of this analysis follows. The last four columns in the table are data on the analysis of the agriculture and metal working occupations combined.

Table 12

Significant Factors from Varimax Rotation of Factor Analysis of Matrix in Table 11

Factor I (32.5%)		Factor II (22.4%)		Factor III (20.9%)		Factor IV (5.0%)	
General farmer	93	Chopper operator	89	Partsman	84	Sale barn yardman	62
Cattle rancher	91	Pellet mill operator	83	Sales, feed	76	Ag. technician	62
Fruit farmer	88	Tree trimmer	82	Secretary & clerical	76	Hatchery worker	47
Grain farmer	86	Food processing	78	Auctioneer	74		
Dairy farmer	86	Cannery	78	Sales, equipment	68		
Vegetable farmer	84	Feed mill	74	Buyer	68		
Cattle feeder	84	Truck driver	73	Artif. breeding tech.	66		
Hog grower	75	Ranch hand	72	Flower grower	65		
Poultry farmer	74	Farm hand	69	Sales, petroleum	65		
Custom operator	74	Groundskeeper	66	Soil tester	61		
Golf course supt.	71	Lumber yard man	62	Veterinarian aid	60		
Sheep grower	69	Mechanic	57	Soil conserv. tech.	58		
Tractor operator	68	Grain elevator	56	Grain elevator worker	53		
Greenskeeper	68	Brand inspector	54	Sales, fertilizer	56		
Mechanic	66	Ditch rider	52	Sheep grower	55		
Herdsman	64	Tractor operator	49	Nursery worker	53		
Nursery worker	63	Veterinarian aid	49	Brand inspector	49		
Sales, fertilizer	62	Hatchery worker	49	Poultry farmer	47		
Farm hand	61	Soil tester	46	Herdsman	42		
Flower grower	56	Artif. breeding tech.	45				
Sales, equipment	55	Sale barn yardman	44				
Grain elevator	54	Soil conserv. tech.	43				
Ranch hand	54	Secretary & clerical	42				
Sales, feed	50	Nursery	41				
Sales, petroleum	50						
Ag. technician	49						
Groundskeeper	48						
Ditch rider	48						
Soil conserv. tech.	42						
Feed mill	41						

Table 13

Occupations Scoring Above and Below the Mean for each Variable by Occupational Cluster

Variable	Metal						Agriculture						Combined							
	Fac I Skill		Fac II Semi Skill		Fac III Busi-ness		Fac I Prod Ag		Fac II Indus-trial		Fac III Busi-ness		Fac I Indus-trial		Fac II Busi-ness		Fac III Prod Ag		Fac IV Skilled or Tech	
	H (12	L 4)	H (14	L 5)	H (7	L 2)	H (15	L 7)	H (15	L 6)	H (8	L 2)	H (26	L 14)	H (14	L 6	H (12	L 5)	H (7	L 2)
Education																				
1. Below H. S.	8	8	11	8	0	9	3	19	9	12	2	8	22	18	3	17	4	13	1	8
2. High School	6	10	6	13	5	4	12	10	8	13	5	5	12	28	11	9	10	7	5	4
3. Vocational	8	8	3	16	4	5	6	16	5	16	2	8	11	29	7	13	6	11	6	3
4. On job tr.	7	9	5	14	1	8	10	12	12	9	7	3	15	25	11	9	7	10	2	7
5. College	2	14	0	19	5	4	11	11	4	17	6	4	2	38	11	9	7	10	4	5
6. Other	6	10	5	14	3	6	7	15	2	19	3	7	9	31	6	14	5	12	3	6
7. Level of sup.	2	14	1	18	5	4	20	2	9	12	9	1	8	32	16	4	16	1	5	4
8. Repet. of job	4	12	13	6	2	7	9	13	14	7	2	8	23	17	7	13	8	9	1	8
Work environment																				
9. Pers. inconv.	2	14	1	18	3	6	14	8	9	12	5	5	6	34	9	11	12	5	2	7
10. Phy. haz.	11	5																		
11. Uncomfortable	6	10	11	8	1	8	6	16	9	12	2	8	22	18	3	17	5	12	2	7
12. Usual	6	10	6	13	5	4	9	13	7	14	4	6	12	28	12	8	6	11	5	4
13. Tech. vocab.	9	7	4	15	5	4	8	14	6	15	5	5	13	27	9	11	6	13	8	1
14. Spec. vision	1	15	5	14	6	3	11	11	9	12	8	2	9	31	17	3	7	10	2	7
Finger movements																				
15. V*	6	10	3	16	2	7	12	10	8	13	6	4	12	28	11	9	6	11	8	1
16. P	9	7	8	11	5	4	13	9	10	11	7	3	20	20	15	5	7	10	8	1

Table 13
(continued)

		Metal						Agriculture						Combined					
17.	F	3	13	3	16	1	8	11	11	8	13	2	8	11	29	4	16	9	8	3	6
18.	I	10	6	9	10	5	4	11	11	8	13	7	3	20	20	15	5	5	12	8	1
19.	Sp	9	7	7	12	3	6	11	11	5	16	4	6	14	26	9	11	7	10	6	3
20.	St	11	5	8	11	1	8	7	15	7	14	2	8	19	21	4	16	4	13	7	2
21.	C	4	12	0	19	2	7	13	9	5	16	8	2	6	34	14	6	7	10	7	2
Arm-hand movement																					
22.	V	9	7	7	12	3	6	9	13	11	10	3	7	18	22	5	15	8	9	8	1
23.	P	14	2	13	6	1	8	11	11	11	10	4	6	27	13	5	15	9	8	7	2
24.	F	5	11	3	16	3	6	10	12	8	13	4	6	10	30	6	14	9	8	3	6
25.	I	8	8	9	10	0	9	10	12	14	7	4	6	23	17	4	16	7	10	6	3
26.	Sp	8	8	14	5	3	6	13	9	8	13	3	7	18	22	6	14	12	5	2	7
27.	St	14	2	16	3	1	8	9	13	11	10	4	6	28	12	4	16	8	9	5	4
28.	C	4	12	4	15	0	9	15	7	13	8	2	8	14	26	3	16	13	4	6	3
Foot-leg movement																					
29.	V	3	13	5	14	1	8	16	6	13	8	4	6	12	28	4	16	15	2	3	6
30.	P	6	10	6	13	3	6	17	5	15	6	4	6	15	25	6	14	13	4	4	5
31.	F	6	10	6	13	2	7	16	6	11	10	1	9	11	29	2	18	14	3	4	5
32.	I	6	10	7	12	1	8	17	5	15	6	4	6	16	24	4	16	14	3	4	5
33.	Sp	6	10	7	12	1	8	17	5	14	7	3	7	15	25	3	17	14	3	4	5
34.	St	5	11	6	13	1	8	16	6	16	5	2	8	16	24	2	18	14	3	4	5
35.	C	2	14	4	15	2	7	17	5	14	7	4	6	11	29	5	15	15	2	3	6
Simul. Coordination																					
36.	V	4	12	2	17	0	9	17	5	14	7	5	5	14	26	6	14	13	4	5	4
37.	P	13	3	12	7	3	6	10	12	11	10	4	6	24	16	8	12	7	10	6	3
38.	F	6	10	7	12	2	7	12	10	9	12	3	7	13	27	4	16	11	6	3	6
39.	I	8	8	9	10	1	8	11	11	14	7	2	8	21	19	5	15	11	6	6	3
40.	Sp	9	7	10	9	3	6	15	7	12	9	4	6	20	20	7	13	12	5	4	5
41.	St	10	6	11	8	0	9	12	10	15	6	3	7	27	13	4	16	10	7	6	3
42.	C	4	12	1	18	2	7	18	4	14	7	5	5	13	27	10	10	13	4	8	1

Table 13
(continued)

		Metal						Agriculture						Combined							
General body activity																					
43.	V	4	12	5	14	0	9	13	9	12	9	2	8	15	25	2	18	11	6	4	5
44.	P	9	7	9	10	1	8	12	10	12	9	4	6	19	21	5	15	9	8	4	5
45.	F	7	9	6	13	2	7	15	7	10	11	3	7	14	26	5	15	14	3	3	6
46.	I	9	7	9	10	1	8	14	8	14	7	3	7	22	18	4	16	10	7	3	6
47.	Sp	9	7	9	10	2	7	14	8	13	8	3	7	20	20	5	15	10	7	4	5
48.	St	11	5	10	9	2	7	12	10	10	11	2	8	21	19	3	17	10	7	5	4
49.	C	9	7	7	12	1	8	16	6	13	8	3	7	18	22	5	15	14	3	5	4
Motor control																					
50.	V	8	8	7	12	1	8	12	10	16	5	4	6	22	18	6	14	8	9	9	0
51.	P	7	9	10	9	0	9	13	9	19	2	5	5	27	13	6	14	10	7	6	3
52.	F	5	11	6	13	3	6	16	6	8	13	4	6	11	29	8	12	14	3	4	5
53.	I	8	8	8	11	0	9	12	10	13	8	4	6	23	17	4	16	10	7	6	3
54.	Sp	8	8	11	8	0	9	10	12	15	6	2	8	26	14	2	18	8	9	4	5
55.	St	7	9	8	11	0	9	14	8	17	4	4	6	24	16	4	16	10	7	5	4
56.	C	5	11	2	17	1	8	16	6	12	9	3	7	12	28	5	15	14	3	6	3
Assembly																					
57.	V	8	8	3	16	2	7	12	10	9	12	2	8	13	27	4	16	10	7	8	1
58.	P	10	6	6	13	0	9	12	10	10	11	3	7	19	21	3	17	8	9	7	2
59.	F	6	10	4	15	1	8	14	8	13	8	2	8	15	25	3	17	12	5	5	4
60.	I	12	4	6	13	1	8	10	12	8	13	3	7	19	21	3	17	6	11	8	1
61.	Sp	11	5	6	13	2	7	11	11	10	11	2	8	19	21	2	18	10	7	6	3
62.	St	10	6	5	14	1	8	8	14	10	11	4	6	18	22	4	16	6	11	5	4
63.	C	10	6	4	15	2	7	12	10	12	9	2	8	19	21	3	17	10	7	9	0
Hand tools																					
64.	V	13	3	10	9	1	8	15	7	14	7	1	9	25	15	1	19	13	4	8	1
65.	P	15	1	12	7	2	7	12	10	15	6	4	6	28	12	6	14	11	6	8	1
66.	F	4	12	4	15	1	8	16	6	13	8	4	6	14	26	5	15	14	3	2	7
67.	I	14	2	7	12	1	8	9	13	11	10	2	8	20	20	2	18	8	9	7	2

Table 13
(continued)

		Metal						Agriculture						Combined					
68.	St	9	7	6	13	1	8	15	7	15	6	3	7	21	19	4	16	14	3	5	4
69.	C	13	3	7	12	1	8	14	8	11	10	3	7	18	22	5	15	11	6	7	2
Near visual discrimination																					
70.	V	9	7	3	16	2	7	11	11	7	14	8	2	14	26	11	9	5	12	9	0
71.	P	9	7	4	15	3	6	12	10	5	16	8	2	15	25	13	7	5	12	7	2
72.	F	3	13	0	19	1	8	16	6	10	11	6	4	10	30	7	13	11	6	4	5
73.	I	9	7	3	16	4	5	13	9	10	11	9	1	15	25	15	5	6	11	8	1
74.	Sp	7	9	7	12	0	9	12	10	9	12	6	4	20	20	7	13	8	9	5	4
75.	C	8	8	0	19	5	4	17	5	7	14	9	1	10	30	16	4	12	5	9	0
Far visual discrimination																					
76.	V	3	13	7	12	0	9	20	2	18	3	7	3	20	20	7	13	15	2	4	5
77.	P	3	13	6	13	3	6	21	1	17	4	8	2	16	24	9	11	16	1	4	5
78.	F	3	13	3	16	4	5	17	5	9	12	5	5	8	32	7	13	15	2	2	7
79.	I	1	15	5	14	2	7	21	1	16	5	8	2	15	25	9	11	14	3	3	6
80.	Sp	1	15	6	13	3	6	20	2	18	3	9	1	17	23	10	10	15	2	3	6
81.	C	0	16	2	17	1	8	20	2	16	5	7	3	12	28	9	11	14	3	3	6
Depth discrimination																					
82.	V	3	13	5	14	0	9	13	9	12	9	2	8	14	26	2	18	12	5	4	5
83.	P	4	12	9	10	0	9	12	10	12	9	5	5	18	22	5	15	11	6	3	6
84.	F	2	14	3	16	0	9	15	7	10	11	3	7	9	31	3	17	13	4	2	7
85.	I	3	13	8	11	0	9	11	11	9	12	5	5	15	25	5	15	10	7	3	6
86.	Sp	3	13	9	10	1	8	12	10	11	10	5	5	17	23	6	14	10	7	2	7
87.	C	2	14	5	14	1	8	14	8	10	11	5	5	12	28	6	14	11	6	3	6
88.	V	3	13	5	14	0	9	12	10	10	11	4	6	16	24	4	16	9	8	3	6
89.	P	4	12	5	14	3	6	12	10	13	8	5	5	17	23	6	14	11	6	3	6
90.	F	2	14	5	14	0	9	14	8	8	13	2	8	10	30	2	18	12	5	2	7
91.	I	3	13	7	12	2	7	13	9	12	9	5	5	18	22	6	14	12	5	3	6
92.	Sp	3	13	5	14	3	6	12	10	12	9	3	7	15	25	4	16	12	5	3	6
93.	C	2	14	2	17	1	8	12	10	10	11	5	5	11	29	6	14	9	8	3	6

Table 13
(continued)

		Metal						Agriculture						Combined					
Estimate quality, etc.																			
94.	V	2	14	6	13	4	5	18	4	5	16	8	2	11	29	13	7	12	5	4	5
95.	P	2	14	6	13	4	5	16	6	9	12	9	1	11	29	13	7	12	5	4	5
96.	F	1	15	1	18	0	9	8	14	4	17	1	9	3	37	1	19	9	8	1	8
97.	I	12	4	13	6	7	2	22	0	17	4	10	0	29	11	18	2	17	0	9	0
98.	Sp	4	12	6	13	2	7	14	8	9	12	8	2	11	29	11	9	11	6	3	6
99.	C	3	13	3	16	3	6	18	4	3	18	8	2	6	34	12	8	14	3	5	4
Color discrimination																			
100.	V	2	14	6	13	2	7	17	5	13	8	6	4	17	23	11	9	12	5	4	5
101.	P	3	13	4	15	2	7	17	5	11	10	7	3	12	28	11	9	12	5	5	4
102.	F	2	14	2	17	3	6	18	4	10	11	3	7	9	31	7	13	14	3	4	5
103.	I	2	14	6	13	2	7	17	5	14	7	5	5	16	24	9	11	13	4	4	5
104.	Sp	3	13	6	13	2	7	19	3	14	7	8	2	16	24	12	8	14	3	5	4
105.	C	0	16	5	14	2	7	18	4	11	10	7	3	12	28	12	8	12	5	4	5
Sound discrimination																			
106.	V	2	14	4	15	1	8	16	6	13	8	5	5	16	24	5	15	12	5	5	4
107.	P	4	12	7	12	2	7	16	6	12	9	4	6	19	21	5	15	13	4	5	4
108.	F	5	11	6	13	2	7	13	9	8	13	3	7	14	26	3	17	11	6	3	6
109.	I	3	13	6	13	1	8	15	7	12	9	3	7	17	23	3	17	13	4	4	5
110.	Sp	6	10	9	10	2	7	14	8	11	10	3	7	21	19	4	16	11	6	5	4
111.	C	1	15	4	15	1	8	15	7	12	9	4	6	14	26	4	16	13	4	4	5
Odor discrimination																			
112.	V	0	16	3	16	0	9	17	5	11	10	6	4	12	28	6	14	10	7	3	6
113.	P	3	13	3	16	0	9	18	4	11	10	5	5	14	26	6	14	12	5	4	5
114.	F	2	14	2	17	2	7	16	6	11	10	4	6	12	28	5	15	14	3	4	5
115.	I	2	14	4	15	0	9	15	7	11	10	5	5	14	26	5	15	9	8	3	6
116.	C	0	16	2	17	0	9	17	5	9	12	7	3	8	32	8	12	12	5	3	6
Sense of touch																			
117.	V	7	9	7	12	0	9	13	9	5	16	2	8	13	27	3	17	10	7	7	2

Table 13
(continued)

		Metal						Agriculture						Combined					
118.	P	8	8	7	12	0	9	10	12	8	13	3	7	17	23	5	15	7	10	8	1
119.	F	6	10	4	15	0	9	12	10	8	13	2	8	12	28	3	17	9	8	6	3
120.	I	9	7	9	10	0	9	11	11	9	12	4	6	21	19	6	14	7	10	8	1
121.	C	5	11	4	15	0	9	11	11	4	17	2	8	10	30	4	16	8	9	8	1
Blind positioning																					
122.	V	4	12	4	15	2	7	15	7	13	8	2	8	15	25	3	17	14	3	5	4
123.	P	8	8	9	10	2	7	14	8	10	11	2	8	18	22	4	16	11	6	5	4
124.	F	7	9	3	16	2	7	14	8	11	10	2	8	13	27	2	18	13	4	4	5
125.	I	7	9	8	11	4	5	15	7	10	11	3	7	17	23	6	14	12	5	5	4
126.	Sp	8	8	8	11	2	7	15	7	13	8	3	7	18	22	4	16	12	5	4	5
127.	C	3	13	3	16	3	6	15	7	11	10	2	8	11	29	5	15	14	3	5	4
Monitoring																					
128.	V	2	14	2	17	1	8	15	7	10	11	1	9	13	27	2	18	13	4	4	5
129.	P	3	13	2	17	2	7	16	6	9	12	4	6	15	25	6	14	12	5	5	4
130.	F	4	12	0	19	2	7	13	9	5	16	4	6	7	33	6	14	12	5	4	5
131.	I	3	13	2	17	2	7	16	6	7	14	4	6	14	26	6	14	12	5	5	4
132.	Sp	3	13	2	17	2	7	16	6	10	11	5	5	16	24	7	13	12	5	5	4
133.	C	3	13	3	16	4	5	15	7	6	15	3	7	12	28	5	15	12	5	4	5
Use math																					
134.	V	8	8	5	14	6	3	18	4	6	15	8	2	11	29	12	8	13	4	8	1
135.	P	10	6	6	13	8	1	16	6	6	15	9	1	15	25	17	3	12	5	7	2
136.	F	3	13	5	14	3	6	16	6	8	13	6	4	9	31	8	12	14	3	2	7
137.	I	8	8	4	15	8	1	16	6	6	15	9	1	10	30	16	4	11	6	7	2
138.	Sp	5	11	5	14	5	4	12	10	7	14	10	0	11	29	14	6	6	11	3	6
139.	C	4	12	2	17	5	4	20	2	6	15	8	2	5	35	14	6	14	3	5	4
Know machine operation																					
140.	V	8	8	5	14	2	7	15	7	12	9	2	8	5	35	14	6	14	3	5	4
141.	P	10	6	7	12	2	7	11	11	9	12	2	8	18	22	4	16	9	8	7	2
142.	F	4	12	2	17	5	4	17	5	10	11	5	5	8	32	7	13	15	2	2	7

Table 13
(continued)

		Metal						Agriculture						Combined					
143.	I	12	4	10	9	2	7	15	7	14	7	2	8	26	14	4	16	11	6	8	1
144.	C	8	8	4	15	2	7	15	7	12	9	1	9	17	23	5	15	13	4	8	1
Know machine assembly																					
145.	V	6	10	3	16	2	7	18	4	12	9	5	5	15	25	6	14	13	4	7	2
146.	P	6	10	4	15	1	8	16	6	11	10	4	6	13	25	4	16	12	5	7	2
147.	F	5	11	6	13	2	7	17	5	14	7	3	7	15	25	6	14	14	3	4	5
148.	I	3	13	4	15	1	8	16	6	9	12	4	6	12	28	4	16	12	5	4	5
149.	C	4	12	3	16	1	8	16	6	11	10	3	7	13	27	3	17	13	4	5	4
Know finished product																					
150.	V	3	13	2	17	6	3	18	4	4	17	7	3	5	35	12	8	13	4	3	6
151.	P	4	12	1	18	6	3	19	3	6	15	8	2	7	33	13	7	14	3	4	5
152.	F	4	12	1	18	5	4	17	5	3	18	5	5	4	36	9	11	14	3	3	6
153.	I	4	12	2	17	6	3	20	2	7	14	8	2	11	29	13	7	14	3	4	5
154.	C	4	12	0	19	6	3	19	3	3	18	8	2	3	37	13	7	15	2	4	5
Know about materials																					
155.	V	7	9	3	16	4	5	19	3	3	18	6	4	7	33	8	12	15	2	4	5
156.	P	8	8	4	15	3	6	18	4	6	15	7	3	14	26	9	11	14	3	5	4
157.	F	5	11	3	16	5	4	18	4	7	14	5	5	8	32	8	12	16	1	3	6
158.	I	6	10	2	17	4	5	19	3	7	14	7	3	12	28	9	11	14	3	5	4
159.	C	5	11	1	18	4	5	19	3	6	15	7	3	8	32	10	10	15	2	4	5
Know processes																					
160.	V	1	15	1	18	5	4	14	8	4	17	6	4	6	34	11	9	11	6	3	6
161.	P	5	11	3	16	5	4	16	6	4	17	7	3	9	31	13	7	12	5	6	3
162.	F	1	15	2	17	4	5	17	5	11	10	5	5	9	31	10	10	13	4	3	6
163.	I	5	11	3	16	5	4	19	3	7	14	7	3	10	30	13	7	15	2	6	3
164.	C	4	12	1	18	6	3	17	5	5	16	8	2	7	33	15	5	13	4	5	4
Know business procedures																					
165.	V	0	16	0	19	4	5	19	3	4	17	8	2	1	39	14	6	13	4	2	7

Table 13
(continued)

		Metal						Agriculture						Combined							
166.	P	0	16	1	18	6	3	20	2	4	17	10	0	1	39	18	2	14	3	2	7
167.	F	0	16	0	19	4	5	21	1	5	16	9	1	1	39	15	5	15	2	2	7
168.	I	0	16	1	18	6	3	20	2	4	17	10	0	1	39	18	2	14	3	2	7
169.	C	0	16	0	19	5	4	21	1	5	16	10	0	1	39	17	3	15	2	2	7
Read and interpret																					
170.	V	3	13	2	17	3	6	16	6	7	14	7	3	7	33	10	10	11	6	5	4
171.	P	8	8	7	12	5	4	16	6	4	17	8	2	13	27	14	6	11	6	8	1
172.	F	1	15	1	18	2	7	17	5	9	12	4	6	6	34	8	12	14	3	3	6
173.	I	9	7	8	11	6	3	18	4	7	14	8	2	15	25	14	6	13	4	9	0
174.	C	5	11	0	19	4	5	15	7	4	17	8	2	6	34	15	5	11	6	7	2
Follow directions																					
175.	V	3	13	5	14	4	5	9	13	9	12	6	4	12	28	12	8	5	12	6	3
176.	P	11	5	10	9	7	2	9	13	13	8	6	4	24	16	13	7	5	12	7	2
177.	F	3	13	2	17	5	4	11	11	9	12	5	5	7	33	10	10	9	8	2	7
178.	C	4	12	1	18	6	3	7	15	6	15	5	5	6	34	12	8	4	13	5	4
Visualization																					
179.	V	12	4	6	13	4	5	8	14	2	19	4	6	12	28	5	15	6	11	7	2
180.	F	11	5	8	11	5	4	12	10	3	18	2	8	14	26	4	16	11	6	5	4
181.	I	12	4	7	12	5	4	11	11	3	18	4	6	12	28	6	14	9	8	6	3
182.	C	13	3	8	11	5	4	12	10	4	17	4	6	15	25	6	14	11	6	7	2
Close concentration																					
183.	V	5	11	2	17	5	4	10	12	5	16	5	5	9	31	11	9	6	11	7	2
184.	F	5	11	3	16	3	6	20	2	7	14	4	6	8	32	6	14	14	3	5	4
185.	I	9	7	5	14	5	4	9	13	5	16	5	5	14	26	11	9	5	12	9	0
186.	C	7	9	1	18	6	3	10	12	5	16	4	6	8	32	11	9	7	10	9	0
Reasoning																					
187.	V	3	13	1	18	5	4	20	2	8	13	7	3	8	32	13	7	16	1	7	2
188.	F	7	9	6	13	3	6	17	5	11	10	5	5	16	24	7	13	14	3	5	4
189.	I	5	11	4	15	5	4	21	1	9	12	7	3	13	27	12	8	17	0	8	1

Table 13
(continued)

	Metal						Agriculture						Combined					
190. Sp	6	10	5	14	4	5	16	6	10	11	4	6	12	28	6	14	13	4	6	3
191. C	6	10	-	10	5	4	21	1	7	14	8	2	8	32	14	6	16	1	9	0
Form policy																				
192. V	2	14	4	15	3	6	18	4	6	15	7	3	5	35	9	11	16	1	2	7
193. P	1	15	3	16	4	5	18	4	7	14	7	3	5	35	10	10	16	1	2	7
194. F	3	13	3	16	5	4	17	5	6	15	6	4	5	35	9	11	16	1	2	7
195. I	2	14	3	16	5	4	17	5	7	14	7	3	5	35	10	10	16	1	2	7
Make work assignments																				
196. V	2	14	6	13	3	6	15	7	6	15	7	3	5	35	10	10	16	1	2	7
197. P	5	11	6	13	5	4	18	4	11	10	7	3	14	26	11	9	15	2	3	6
198. F	3	13	3	16	3	6	15	7	6	15	5	5	7	33	8	12	13	4	3	6
199. C	4	12	5	14	[illegible]	4	14	8	5	16	7	3	8	32	11	9	10	7	3	6
Develop budget																				
200. V	2	14	1	18	3	6	19	3	2	19	8	2	1	39	10	10	15	2	2	7
201. P	3	13	2	17	4	5	21	1	4	17	9	1	2	38	12	8	16	1	3	6
202. F	3	13	2	17	6	3	18	4	3	18	6	4	3	37	12	8	16	1	4	5
203. I	3	13	2	16	3	6	21	1	4	17	9	1	3	37	12	8	16	1	4	5
204. C	3	13	1	18	5	4	20	2	3	18	8	2	1	39	12	8	16	1	3	6
Inspect																				
205. V	2	14	4	15	2	7	19	3	8	13	6	4	9	31	9	11	14	3	5	4
206. P	5	11	5	14	3	6	20	2	7	14	7	3	12	28	10	10	14	3	5	4
207. F	1	15	1	18	1	8	19	3	7	14	6	4	4	36	9	11	14	3	2	7
208. I	5	11	5	14	3	6	20	2	9	12	7	33	14	26	10	10	14	3	5	4
209. C	4	12	2	17	4	5	20	2	7	14	6	4	7	33	10	10	16	1	5	4
Buy or order																				
210. V	4	12	1	18	4	5	21	1	7	14	6	4	4	36	10	10	16	1	5	4
211. P	2	14	2	17	6	3	20	2	8	13	7	3	4	36	13	7	16	1	3	6
212. F	3	13	1	18	6	3	21	1	12	9	9	1	7	33	15	5	17	0	4	5
213. I	4	12	2	17	6	3	21	1	6	15	8	2	5	35	14	6	16	1	5	4
214. C	2	14	1	18	4	5	20	2	8	13	8	2	2	38	12	8	17	0	3	6

Table 13
(continued)

		Metal						Agriculture						Combined							
Speak to others																					
215.	V	3	13	6	13	8	1	13	9	6	15	4	6	8	32	10	10	12	5	3	6
216.	P	5	11	5	14	7	2	14	8	7	14	5	5	9	31	11	9	13	4	4	5
217.	F	3	13	5	14	3	6	11	11	9	12	3	7	11	29	5	15	10	7	2	7
218.	I	6	10	5	14	6	3	16	6	8	13	6	4	11	29	10	10	14	3	4	5
219.	C	5	11	5	14	6	3	15	7	6	15	6	4	10	30	11	9	14	3	5	4
Written communication																					
220.	V	2	14	2	17	6	3	12	10	3	18	7	3	3	37	14	6	8	9	4	5
221.	P	3	13	4	15	6	3	15	7	7	14	7	3	10	30	14	6	10	7	6	3
222.	F	1	15	2	17	4	5	17	5	5	16	7	3	6	34	13	7	13	4	4	5
223.	I	2	14	3	16	5	4	14	8	6	15	8	2	8	32	14	6	9	8	4	5
224.	C	2	14	2	17	8	1	15	7	4	17	8	2	4	36	16	4	10	7	5	4
Hand signals																					
225.	V	2	14	5	14	1	8	5	17	8	13	1	9	12	28	1	19	5	12	1	8
226.	F	1	15	4	15	0	9	13	9	9	12	4	6	12	28	4	16	11	6	1	8
227.	I	2	14	5	14	3	6	7	15	9	12	1	9	13	27	2	18	8	9	1	8
228.	C	3	13	6	13	1	8	5	17	8	13	1	9	13	27	1	19	5	12	1	8
Persuasive communication																					
229.	V	2	14	1	18	5	4	14	8	2	19	9	1	2	38	12	8	10	7	3	6
230.	F	2	14	1	18	4	5	16	6	6	15	9	1	4	36	13	7	11	6	3	6
231.	I	2	14	1	18	6	3	16	6	7	14	10	0	5	35	14	6	12	5	3	6
232.	C	2	14	1	18	5	4	15	7	4	17	9	1	3	37	12	8	10	7	3	6
Personal service																					
233.	V	1	15	3	16	5	4	13	9	7	14	10	0	6	34	16	4	7	10	3	6
234.	F	2	14	2	17	6	3	17	5	4	17	9	1	3	37	15	5	11	6	3	6
235.	I	1	15	2	17	5	4	14	8	6	15	10	0	5	35	16	4	10	7	2	7
236.	Sp	2	14	3	16	6	3	13	9	6	15	10	0	6	34	16	4	9	8	2	7
237.	C	1	15	2	17	4	5	14	8	5	16	9	1	2	38	15	5	9	8	3	6

Table 13
(continued)

		Metal						Agriculture						Combined					
238.	Files	0	16	2	17	4	5	15	7	4	17	7	3	2	38	15	5	11	6	3	6
239.	Types	0	16	0	19	4	5	12	10	2	19	7	3	0	40	15	5	8	9	1	8
240.	Calculator	0	16	0	19	5	4	13	9	5	16	9	1	2	38	17	3	9	8	2	7
241.	Bookkeeping	1	15	2	17	3	6	17	5	5	16	7	3	3	37	14	6	14	3	3	6
242.	Inventory	2	14	2	17	5	4	14	8	8	13	9	1	7	33	12	8	11	6	0	9
243.	Duplicator	0	16	0	19	5	4	3	19	0	21	2	8	0	40	8	12	2	15	1	8
244.	Receptionist	2	14	1	18	6	3	7	15	3	18	8	2	2	38	15	5	3	14	2	7
245.	Other clerical	0	16	3	16	4	5	5	17	3	18	3	7	3	37	8	12	3	14	0	9
Contact with																					
246.	Management	5	11	5	14	8	1	8	14	7	14	7	3	11	29	14	6	3	14	2	7
247.	Foremen	12	4	17	2	5	4	2	20	6	15	1	9	27	13	5	15	2	15	4	5
248.	Non-supervis.	9	7	13	6	4	5	8	14	5	16	0	10	23	17	4	16	7	10	7	2
249.	Clerical work.	2	14	4	15	7	2	5	17	5	16	5	5	6	34	12	8	3	14	2	7
250.	Salesmen	2	14	4	15	6	3	19	3	5	16	8	2	7	33	14	6	14	3	2	7
251.	Professionals	6	10	3	16	7	2	8	14	4	17	2	8	7	33	8	12	6	11	6	3
252.	Customers	2	14	2	17	5	4	16	6	8	13	10	0	8	32	16	4	11	6	3	6
253.	Public	1	15	1	18	2	7	10	12	8	13	5	5	3	37	7	13	8	9	2	7
254.	VIP	3	13	3	16	6	3	11	11	6	15	5	5	6	34	9	11	9	8	2	7
255.	Applicants	1	15	2	17	3	6	15	7	8	13	4	6	5	35	7	13	14	3	2	7
256.	Trainees	6	10	4	15	2	7	6	16	5	16	3	7	9	31	7	13	4	13	3	6
257.	Suppliers	1	15	0	19	5	4	21	1	6	15	7	3	2	38	11	9	17	0	3	6
258.	Supervise	3	13	4	15	7	2	16	6	6	15	5	5	8	32	10	10	13	4	2	7
259.	Monitor	4	12	8	11	6	33	18	4	13	8	7	3	18	22	13	7	13	4	4	5
260.	Hires	1	15	0	19	3	6	18	4	6	15	6	4	2	38	7	13	16	1	2	7
261.	Fires	1	15	0	19	3	6	18	4	6	15	5	5	3	37	6	14	15	2	2	7
262.	Promotes	2	14	2	17	2	7	16	6	5	16	5	5	3	37	6	14	14	3	2	7
263.	Make work sch.	3	13	3	16	4	5	19	3	9	12	6	4	6	34	9	11	16	1	2	7
264.	Regulate self	2	14	3	16	2	7	12	10	4	17	6	4	6	34	9	11	10	7	4	5
265.	Regulate others	2	14	3	16	4	5	17	5	8	13	5	5	9	31	7	13	14	3	2	7
266.	Safety resp.	7	9	7	12	4	5	19	3	10	11	5	5	16	24	7	13	15	2	5	4
267.	Make decisions	2	14	0	19	3	6	18	4	3	18	7	3	1	39	9	11	14	3	2	7

Table 13
(continued)

	Metal						Agriculture						Combined					
268. Jumping	0	16	0	19	0	9	2	20	2	19	0	10	0	40	0	20	2	15	0	9
269. Running	0	16	0	19	0	9	11	11	10	11	3	7	6	34	5	15	9	8	2	7
270. Balancing	11	5	10	9	2	7	15	7	18	3	5	5	27	13	7	13	12	5	6	3
271. Climbing	4	12	6	13	2	7	10	12	12	9	5	5	18	22	6	14	7	10	4	5
272. Crawling	6	10	4	15	1	8	10	12	11	10	1	9	13	27	2	18	8	9	3	6
273. Standing	11	5	8	11	1	8	11	11	12	9	4	6	24	16	5	15	8	9	8	1
274. Stooping	11	5	11	8	2	7	15	7	11	10	4	6	23	17	6	14	10	7	7	2
275. Crouching	7	9	8	11	2	7	11	11	8	13	4	6	16	24	5	15	7	10	5	4
276. Kneeling	7	9	6	13	2	7	10	12	11	10	3	7	17	23	4	16	8	9	5	4
277. Sitting	2	14	5	14	5	4	15	7	10	11	7	3	11	29	14	6	10	7	3	6
278. Reaching	7	9	9	10	4	5	10	12	13	8	4	6	19	21	7	13	9	8	4	5
279. Lifting	13	3	12	7	1	8	10	12	12	9	4	6	25	15	6	14	9	8	6	3
280. Carrying	8	8	10	9	1	8	11	11	10	11	3	7	17	23	5	15	10	7	3	6
281. Throwing	2	14	2	17	1	8	10	12	7	14	0	10	5	35	1	19	10	7	3	6
282. Pushing	5	11	7	12	0	9	9	13	11	10	4	6	19	21	4	16	6	11	4	5
283. Pulling	5	11	7	12	0	9	9	13	12	9	3	7	21	19	3	17	7	10	4	5
284. Handling	10	6	13	6	3	6	10	12	12	9	4	6	25	15	9	11	9	8	5	4
285. Fingering	8	8	7	12	3	6	9	13	5	16	3	7	17	23	8	12	6	11	7	2
286. Salaried	0	16	1	18	5	4	9	13	14	7	8	2	10	30	14	6	3	14	3	6
287. Hourly pay	15	1	19	0	3	6	1	21	8	13	0	10	34	6	2	18	0	17	5	4
288. Self-employed	1	15	0	19	0	9	13	9	2	19	2	8	0	40	4	16	13	4	2	7
289. Optional dress	7	9	8	11	6	3	13	9	14	7	3	7	17	23	9	11	15	2	3	6
290. Work clothes	11	5	13	6	2	7	12	10	12	9	0	10	25	15	3	17	14	3	6	3
291. Special cloth.	7	9	8	11	2	7	0	22	3	18	0	10	16	24	1	19	1	16	3	6
292. **DOT-Data	8	8	18	1	1	8	6	16	20	1	3	7	33	7	4	16	5	12	0	9
293. **DOT-People	13	3	18	1	1	8	17	5	16	5	1	9	34	6	5	15	14	3	8	1
294. **DOT-Things	3	13	7	12	6	3	7	15	14	7	10	0	15	25	16	4	3	14	0	9
295. GED	8	8	1	18	7	2	19	3	3	18	7	3	9	31	16	4	15	2	9	0
296. SVP	10	6	4	15	6	3	16	6	4	17	2	8	13	27	7	13	16	1	9	0
DOT aptitudes																				
297. **G Intelligence	8	8	10	9	2	7	1	21	10	11	1	9	17	23	2	18	0	17	1	8
298. **V Verbal	7	9	17	2	1	8	2	20	18	3	1	9	31	9	2	18	3	14	0	9

Table 13
(continued)

	Metal						Agriculture						Combined					
299.**N Numer.	6	10	17	2	2	7	3	19	17	4	5	5	30	10	8	12	1	16	0	9
300.**S Spatial	3	13	9	10	5	4	2	20	15	6	6	4	20	20	11	9	0	17	0	9
301.**P Form Percep.	2	14	9	10	3	6	4	18	15	6	3	7	18	22	7	13	2	15	0	9
302.**Q Cler. Per.	6	10	14	5	0	9	2	20	16	5	1	9	26	14	1	19	2	15	0	9
303.**K Mot. Coord.	4	12	6	13	3	6	2	20	7	14	5	5	12	28	8	12	0	17	0	9
304.**F Finger dex.	2	14	9	10	3	6	4	18	14	7	3	7	17	23	6	14	2	15	0	9
305.**M Mon. dex.	2	14	5	14	7	2	4	18	9	12	7	3	11	29	13	7	0	17	0	9
306.**E Eye h. f. co.	15	1	15	4	9	0	5	17	11	10	9	1	29	11	17	3	[illegible]	15	7	2
307.**C Color dis.	16	0	18	1	3	6	5	17	19	2	3	7	40	0	6	14	3	14	6	3
DOT Interests																				
308. 1 Things	11	5	17	2	0	9	17	5	17	4	1	9	34	6	3	17	14	3	6	3
309. 2 Bus. cont.	0	16	0	19	5	4	4	18	0	21	8	2	0	40	13	7	0	17	0	9
310. 3 Routine	3	13	11	8	2	7	5	17	18	3	3	7	23	17	7	13	3	14	0	9
311. 6 Comm.	0	16	1	18	6	3	3	19	0	21	7	3	0	40	13	7	0	17	0	9
312. 7 Sci.	0	16	0	19	0	9	16	6	1	20	2	8	0	40	5	15	13	4	3	6
313. 9 Nonsocial	14	2	15	4	2	7	15	7	11	10	1	9	30	10	2	18	15	2	8	1
314. 0 Tang. outc.	9	7	5	14	1	8	13	9	4	17	0	10	14	26	2	18	12	5	7	2
DOT Temperaments																				
315. 1 Change	7	9	2	17	2	7	16	6	2	19	2	8	6	34	3	17	15	2	6	3
316. 2 Repet.	3	13	12	7	3	6	5	17	18	3	2	8	23	17	5	15	3	14	0	9
317. 3 Specific ins.	2	14	9	10	3	6	5	17	15	6	3	7	17	23	7	13	3	14	0	9
318. 4 Direct others	1	15	0	19	4	5	17	5	4	17	3	7	2	38	6	14	15	2	2	7
319. 5 People	1	15	0	19	7	2	6	16	4	17	9	1	2	38	14	6	3	14	0	9
320. 7 Influence	0	16	1	18	4	5	3	19	0	21	7	3	0	40	10	10	0	17	0	9
321. 9 Eval. I	0	16	2	17	5	4	18	4	1	20	8	2	1	39	13	7	13	4	2	7
322. 0 Eval. II	12	4	7	12	1	8	12	10	4	17	1	9	17	23	5	15	12	5	8	1
323. Y Att. limits	14	2	16	3	2	7	3	19	12	9	0	10	33	7	4	16	2	15	7	2
DOT Physical dem.																				
324. Lifting	11	5	12	7	3	6	17	5	10	11	7	3	17	23	2	18	16	1	8	1

Table 13
(continued)

		Metal						Agriculture						Combined							
325.	Climbing	8	8	6	13	2	7	17	5	9	12	0	10	17	23	2	18	16	1	8	1
326.	Stooping	10	6	9	10	1	8	17	5	11	10	1	9	22	18	3	17	15	2	8	1
327.	Reaching	15	1	18	1	3	6	15	7	17	4	1	9	36	4	5	15	16	1	8	1
328.	Talking	1	15	1	18	7	2	5	17	5	16	5	5	1	39	10	10	4	13	0	9
329.	Seeing	10	6	9	10	2	7	16	6	12	9	1	9	22	18	4	16	15	2	9	0

* V-variety, P-precision, F-frequency, I-importance, Sp-Speed, St-strength, and C-complexity.

** These scales are reversed in that a low number is indicative of a high level of the characteristic.

To build Table 13, a mean score across all 83 occupations was computed for each variable. The score for each occupation on a variable was then compared with the mean. If the score for the occupation was above the mean the occupation was regarded as a high scorer on that variable. If the score was at the mean or below the occupation was regarded as a low scorer on that variable.

A tally was then made of the number of occupations in a cluster that scored above and below the mean on each variable. An arbitrary decision was made to include in the tally for each cluster either all of the occupations if there were fewer than 10, ten occupations, or all occupations with loadings of .50 or greater.

A basic assumption for interpreting the data in Table 13 is that if a large proportion of the jobs in a cluster scored above the mean on a variable then that variable is a characteristic of that cluster. If a large proportion score below the mean then that variable is not characteristic of the cluster, and, finally, if the proportions of high and low scores are about equal then that characteristic is exhibited to a moderate degree on the cluster. The numbers at the top of each column are those values that would yield a Chi squared value of significance at the .10 level or less when testing the observed outcome against an expected equal split. The numbers are presented as high-large and low-small, but they apply either way. Thus in column one any variable count that is split 15-7 or 7-15 or more extreme is deviating significantly from an expected equal split.

The point needs to be emphasized that the classifications of high or low score on a variable for an occupation are relative to the occupations included in the study. Were the occupations in this study to be compared with a different group of occupations the resultant classifications could be very different. Despite this limitation the classifications do indicate within a cluster those behaviors that are dominant and it also allows a determination of the behaviors that apparently differentiated the clusters.

The three agriculture clusters are discussed in the following paragraphs. The metal working clusters and the clusters from the combined analysis are discussed following the presentation of each analysis. The discussion of the 41 behaviors will be primarily in terms of items rather than specific scales within an item. An item was considered to be a high or low scoring item if more than half of the scales in the item exhibited the split required for significance at the .10 level.

The first factor in the analysis of the agricultural occupations was identified as a production agriculture factor. The occupations in this cluster tended to score at an average or high level on nearly all of the variables. This result was not surprising. The farming occupations are probably as varied in terms of behavior as any occupation. Consequently, a cluster of such occupations would be expected to exhibit evidence of performing many different behaviors.

The production agriculture cluster did not conform to some outmoded stereotypes of the farmer, however. The physical behaviors, which many people would regard as characteristic of the farmer, were reported as being performed at an average level. The one exception was foot-leg movement which would be a behavior used in the operation of machinery. On the other hand, the occupations in this cluster generally scored at a high level on every responsibility and decision making item, on nine of the twelve intellectual items, on seven of the eleven discrimination items, and on two of the five communication items. Thus the production agriculture cluster apparently was characterized primarily by behaviors associated with management rather than physical behaviors. Sych a result would be expected by those who are familiar with what is required of a farmer today.

The scores of the occupations in the production agriculture cluster on the general, clerical, and DOT variables were consistent with the pattern of scores exhibited on the 41 behavior items.

The second agricultural factor was identified as a cluster of occupations in agriculture industry. Generally the occupations in this cluster scored at an average or low level on the behavioral items. The generally low scores of the occupations in this cluster on the physical behaviors was not expected. Foot-leg movement and motor control were the physical behavior items that received generally high scores in this cluster. The far visual discrimination item also received high scores. Perhaps the high scores on these three items indicates that the occupations in this cluster are characterized by machine operation. This suggestion is supported by the fact that the only intellectual behavior items that received more high scores than low scores on a majority of the scales were the knowledge of machine operation and knowledge of machine assembly items.

Beside far visual discrimination, the only other discrimination item that had a significant deviation from an expected even split was the estimation of quality, quantity, or size. Apparently the occupations in this cluster do not often need to make such estimations nor are the estimations complex. When such estimations are made, however, they apparently are quite important.

In the intellectual behaviors area, the occupations in the agriculture industry cluster scored at a low level except on the two previously mentioned machine knowledge items, on the following direction item, and on the reasoning item. The occupations in this cluster exhibited low levels of responsibility and decision making. There was some evidence that such behaviors were most often shown in connection with inspection or buying and ordering. A generally low level of communication behavior was also exhibited. The scores of this cluster on the clerical, general, and DOT items were generally consistent with the scores on the 41 behaviors. One exception to this was that the occupations in this cluster scored at a generally high level on the specific physical behavior check list whereas they scored at an average level on the physical behaviors items.

The third agricultural factor was made up primarily of occupations in business and sales and was labeled an agri-business cluster. The occupations in this cluster tended to score at a low average level on the physical behavior items. On the discrimination behavior items, the occupations scored at a high level on the near and far visual discrimination items and the estimation of quality, quantity, or size item. The scores were at the average level on the discrimination items except for the sense of touch and blind positioning items on which the scores were low. Several of the intellectual behavior items exhibited high scores by the occupations in this cluster. Generally the scores were high in this area except for the items dealing with knowledge of machines.

The agri-business occupations also tended to score at a high average level on the responsibility and decision making items with the highest scores being on business related items such as developing a budget and buying or ordering.

As would be expected, the communication behavior items, except for hand signals, had high scores in the jobs in the agri-business cluster. Again the clerical, general, and DOT scores of the occupations in this cluster were consistent with the scores on the 41 behavior items.

Comparison Across Factors

The differentiation between the production agriculture and agriculture industry factors seemed to result to a great extent from the level of behavior shown. There were some clear differences, however, especially on the intellectual, responsibility and decision making, and the communication items. The production cluster scored high on most of these items and the industry cluster scored low. There was a tendency for the occupations in the industry cluster to score higher on behaviors associated with machine operation than the production cluster.

The production and business clusters were differentiated by the physical behaviors in that the production cluster scored at a high average level on these behaviors and the business cluster scored at a low average level. The pattern of scores on the discrimination items was also somewhat different. The production cluster scored quite high on the sound discrimination, sense of touch, blind positioning and monitoring items while the business cluster scored low on these items. On the other hand the business cluster scored high on the near visual discrimination item while the production cluster scored at an average level.

The pattern of scores of these two clusters on the intellectual and responsibility and decision making items was quite similar. Generally the scores were high except for low scores for the business cluster on the machine operation items. The scores on the communication behavior items were also quite similar for the two clusters. The business cluster scored very high on the persuasive communication and personal service items.

The industry and business clusters were differentiated in about the same way as the production and business clusters. The industry cluster generally scored at a higher level on the physical and discrimination behavior items, but at a lower level on the other items than the business cluster.

One of the questions guiding this study was whether the method would identify behaviors that could serve as a basis for curriculum building. Some curricular implications are suggested by the results. One conclusion is that if the vocational agriculture curriculum, as presently constituted, does provide adequately for the behaviors measured by the instrument, then the curriculum would also be useful in preparing persons for the occupations in the other clusters. This conclusion is based on the high average or high level of scores of the occupations in the production agriculture cluster on nearly all items.

On the other hand, the results also suggest that a curriculum designed for training persons for occupations in the industry cluster need not be as complex or lengthy as the curriculum for production agriculture. It would appear that machine operation should receive more emphasis in an industry worker curriculum whereas the production agriculture curriculum would place greater emphasis on management behaviors.

The agri-business curriculum would, on the basis of these results, also concentrate on management, decision making, and communicative behaviors and would have less concentration on the physical and discriminative behaviors than training curricula for occupations in the other two clusters. The agri-business cluster also does not appear to be as behaviorally complex as the production agriculture cluster.

Although the similarities and differences among the three clusters are suggestive of curricular implications, it should be emphasized that specific curricular content is not obvious from these similarities and differences. Research such as is being conducted by Rahmlow and Leonard (1966) should be helpful in further defining the specific curriculum content for clusters such as those identified in this study.

36 Metal Working Occupations

The clustering procedures employed with the 36 metal working occupations were the same as used with the agriculture occupations. A matrix of correlations between the 36 occupations was derived and factor analyzed with the principal axis procedure. The correlation matrix is presented in Table 14.

Twenty factors were extracted to account for 96.8 per cent of the variance in the original matrix. Seven factors, accounting for 86.9 per cent of the variance were rotated. The rotated loadings are presented in Table 15.

As with the agriculture occupations, three strong and distinct clusters came out among the metal working occupations. The three factors accounted for 71.2 per cent of the original variance. Factor I was made up of occupations that were primarily at the semi-skilled level while Factor II seemed to define the skilled occupations. Factor III was interpreted as a business or personal contact factor. Factors IV and V were not interpreted because of few occupations with high loadings on either.

The D" matrix for the metal working occupations is presented in Table 16. The largest difference, 834, occurred between

Table 14

Correlation Coefficients Between 36 Metal Occupations
(Order is the same as for the metal occupations in Table 4)

1.																								
2.	87																							
3.	87	89																						
4.	90	86	84																					
5.	93	84	87	90																				
6.	82	89	95	79	81																			
7.	89	90	89	88	92	83																		
8.	73	73	65	75	74	62	72																	
9.	88	81	78	90	88	72	87	74																
10.	84	85	78	86	86	72	90	71	86															
11.	85	90	86	86	86	82	89	71	86	86														
12.	75	69	65	73	78	58	77	66	82	79	75													
13.	71	80	74	72	68	72	74	73	71	68	73	61												
14.	80	85	77	80	75	76	77	75	74	77	82	65	72											
15.	82	85	93	78	82	92	84	65	72	71	83	57	74	76										
16.	78	77	69	81	81	62	83	63	83	88	81	85	58	72	59									
17.	75	74	72	72	79	65	80	64	74	77	74	77	60	68	62	84								
18.	77	73	61	76	76	56	73	84	75	73	69	64	69	71	59	68	65							
19.	79	82	79	77	76	77	81	71	80	73	80	67	79	74	75	68	71	74						
20.	67	64	63	66	66	60	65	86	65	62	66	60	60	69	64	52	55	70	64					
21.	76	84	79	81	77	76	83	65	81	82	86	66	67	76	77	76	64	62	74	58				
22.	46	45	39	40	38	39	36	67	37	33	39	32	57	58	44	21	31	57	48	65	31			
23.	52	51	43	48	51	41	47	65	47	45	50	46	51	62	43	43	52	65	51	64	40	75		
24.	88	87	89	86	92	84	93	70	85	86	87	75	66	77	84	81	75	67	74	64	81	35	48	
25.	81	87	89	80	80	86	84	63	75	75	81	61	68	76	86	65	67	57	72	65	77	39	40	86
26.	83	85	80	83	83	75	85	70	84	85	86	75	69	77	72	79	76	68	73	64	78	38	54	86
	77																							
27.	73	71	70	62	63	69	67	58	62	57	65	53	72	73	67	48	57	56	68	57	54	56	51	61
	71	65																						
28.	88	76	78	86	89	71	84	70	86	83	79	77	62	70	71	77	69	72	71	65	73	36	49	84
	72	81	59																					
29.	52	50	46	48	50	47	46	75	50	41	46	42	55	55	49	36	43	61	52	69	39	73	74	50
	45	51	50	52																				
30.	74	82	77	70	67	79	70	56	64	63	73	47	65	73	76	54	59	56	70	59	64	46	49	68
	76	72	72	59	45																			

Table 14
(continued)

31.	80	76	75	84	83	70	80	66	83	79	78	75	62	68	69	73	69	64	67	57	74	30	44	79
	68	78	52	81	42	59																		
32.	74	78	78	76	74	74	78	55	65	72	74	55	59	72	72	64	60	56	66	49	65	30	39	75
	70	65	55	64	31	64	67																	
33.	75	67	67	77	77	61	75	56	78	72	69	72	58	57	61	72	66	62	64	43	63	25	32	70
	59	66	50	72	35	52	70	56																
34.	70	72	68	69	70	65	73	54	68	66	72	62	64	63	64	64	61	63	75	54	66	32	43	68
	66	67	59	63	32	60	62	60	63															
35.	73	65	63	75	74	56	70	68	76	69	70	69	62	64	58	68	71	69	64	62	59	39	49	66
	60	70	57	68	50	56	71	51	68	58														
36.	67	68	61	74	67	59	69	53	75	69	66	60	58	57	56	63	52	57	63	41	64	20	29	61
	55	63	45	71	29	53	68	61	64	47	53													

Table 15

Significant Factors from Varimax Rotation of Factor Analyses of Matrix in Table 14

Factor I (27.7%)		Factor II (27.7%)		Factor III (15.7%)		Factor IV (5.9%)	
Tool & die	83	Forklift	84	Purchasing agent	90	Cupola tender	75
Pattern maker	81	Crane operator	81	Sales, equipment	82		
Machinist	81	Truck driver	77	Sales, building	80		
Mechanic	79	Punch press opr.	70	Secretary	67	**Factor V (4.6%)**	
Milling mach. opr.	71	Painter	67	Clerk	66		
Sheet metal	69	Packager	66	Stockman	54	Drop hammer	56
Boilermaker	68	Lathe operator	65	Foreman	50	Heat treater	47
Blacksmith	65	Shear mach.	63	Inspector	48	Inspector	47
Brake operator	64	Metal pourer	63	Metal fabricator	48		
Molder	64	Grinder	63				
Lathe operator	64	Welder (machine)	61				
Welder	58	Drill press	61				
Assembler	56	Milling mach. opr.	60				
Metal fabricator	56	Assembler	58				
Shear mach.	55	Brake operator	57				
Punch press	52	Welder	57				
Grinder	49	Stockman	57				
Welder (machine)	48	Drop hammer	52				
Heat treater	47	Molder	50				
Foreman	46	Clerk	48				
Painter	45	Sheet metal	45				
Inspector	41	Heat treater	45				
		Metal fabricator	44				

purchasing agent and cupola tender and the smallest difference, 57, occurred between machinist and pattern maker.

Twenty factors, which accounted for 97.2 per cent of the total variance were extracted and seven were rotated. The seven factors accounted for 87.7 per cent of the total variance. The rotated factors are presented in Table 17. Only the first three factors had more than two loadings greater than .40 so the other four were omitted from the table.

Again it was obvious that the analysis of the D" matrix yielded highly similar results to the analysis of the correlation matrix.

On the basis of the two analysis it was concluded that the 36 metal working occupations included in the study formed three distinct occupational clusters; semi-skilled, skilled, and business or personal contact occupations.

A discussion of the behaviors characterizing each cluster in the metal-working area is presented next.

Common Behaviors in Metal-Working Occupations

The scores of the metal working occupation factors are shown in columns four, five, and six of Table 13. One obvious result for the metal working clusters is that the occupations in these clusters tended to score at a lower level on all items than the agricultural occupations. One possible reason for this is the relatively greater specificity of the job in metal working than of jobs in agriculture.

The first factor in the metal working analysis was labeled a skilled worker occupational cluster. Generally the occupations in this cluster scored at a low average or low level. Within the cluster the highest scores were obtained on the physical behavior items; the near visual, sense of touch, and blind positioning items in the discrimination area; and the math usage, knowledge of machine operations, and knowledge of materials, and visualization items in the intellectual area. All other items had generally low scores. The scores on the clerical, general, and DOT variables were consistent with these results.

Factor II in the metal working analysis consisted of occupations that seemed to define a semi-skilled cluster. The occupations in this cluster scored at a low level on nearly all items. The

Table 16

Difference Matrix Between 36 Metal Occupations
(Order same as Table 4)

1.																													
2.	90																												
3.	89	90																											
4.	90	88	84																										
5.	92	85	87	91																									
6.	84	89	95	78	80																								
7.	88	90	87	90	92	80																							
8.	76	78	67	79	76	63	76																						
9.	89	84	79	91	88	73	88	78																					
10.	83	85	76	89	86	69	92	76	87																				
11.	88	92	88	89	87	83	90	77	88	87																			
12.	74	71	64	76	78	55	79	71	83	81	77																		
13.	74	82	74	77	71	70	79	79	76	74	78	68																	
14.	84	88	80	80	75	79	75	76	76	74	84	63	72																
15.	83	86	93	78	82	92	82	66	73	69	83	56	73	77															
16.	79	80	70	83	82	61	85	67	84	88	83	85	64	72	59														
17.	74	72	70	65	72	63	69	56	68	65	70	64	50	69	56	76													
18.	80	79	65	80	78	60	78	87	80	77	76	69	75	74	62	72	60												
19.	83	86	82	80	78	80	82	74	83	74	84	68	80	79	77	71	69	78											
20.	71	69	65	67	66	62	65	85	68	62	70	59	62	72	63	53	52	73	68										
21.	76	84	77	83	77	73	85	69	82	84	86	69	72	73	75	77	52	66	74	58									
22.	48	4	37	39	34	36	34	65	36	29	41	27	55	58	39	17	21	57	49	63	26								
23.	58	57	47	49	50	43	46	64	49	43	54	42	51	67	43	43	50	66	56	65	37	73							
24.	86	86	86	86	92	80	93	72	85	87	87	76	69	74	82	81	64	69	74	62	81	28	44						
25.	82	87	90	81	80	86	83	65	76	74	82	60	69	77	86	65	62	61	74	66	76	35	41	84					
26.	85	87	81	84	83	76	84	72	85	83	88	74	70	80	73	80	73	72	76	66	77	36	56	84	78				
27.	78	78	75	65	64	74	66	62	66	57	71	52	71	80	69	52	60	63	74	63	55	57	59	58	72	70			
28.	87	77	77	86	89	69	84	72	87	83	80	76	64	69	69	77	61	73	71	64	73	30	46	83	71	81	59		
29.	54	55	46	51	50	45	48	76	52	43	50	43	59	56	47	36	33	64	54	69	40	70	71	48	44	51	51	50	
30.	67	73	70	55	53	73	52	40	51	43	63	25	45	69	66	[illegible]	53	44	62	50	44	32	42	49	65	63	69	42	27

Table 16
(continued)

31.	80	76	74	84	82	68	79	67	83	78	78	73	63	67	67	72	61	66	69	56	73	22	41	77
	66	77	52	80	38	43																		
32.	68	72	73	67	65	69	67	44	56	59	68	40	47	68	65	54	50	48	60	40	53	12	28	64
	62	58	50	53	14	51	56																	
33.	75	69	65	78	77	58	75	58	78	71	70	71	60	57	58	71	57	64	64	42	62	16	28	68
	57	65	50	70	32	34	68	43																
34.	63	66	60	62	63	56	67	47	62	59	66	53	57	55	55	56	45	56	69	44	58	13	29	60
	57	59	50	54	17	37	52	42	54															
35.	66	57	54	66	64	44	58	57	67	56	62	55	48	55	46	57	59	60	55	52	45	20	36	53
	49	62	48	56	34	37	60	30	56	39														
36.	59	62	52	70	61	48	65	49	71	66	61	55	55	47	45	57	31	53	56	30	59	00	13	54
	46	55	34	65	17	23	61	41	57	27	30													

Table 17

Significant Factors from Varimax Rotation of Factor Analysis of Matrix in Table 16

Factor I (31.7%)	
Crane operator	83
Forklift	78
Painter	71
Punch press	77
Grinder	73
Metal pourer	71
Assembler	71
Stockman	69
Welder (machine)	69
Drill press	69
Lathe operator	68
Clerk	67
Cupola tender	66
Mill machine opr.	63
Molder	62
Brake operator	60
Shear mach.	59
Welder	58
Packager	57
Inspector	56
Sheet metal	51
Heat treater	51
Truck driver	46
Secretary	45
Metal fabricator	42
Drop hammer	42
Sales, equipment	41

Factor II (23.7%)	
Pattern maker	78
Tool & die	78
Machinist	76
Mechanic	75
Boilermaker	71
Mill machine opr.	68
Sheet metal	62
Molder	61
Drill press	60
Brake operator	58
Lathe operator	56
Blacksmith	54
Welder	52
Assembler	51
Shear mach.	49
Metal fabricator	49
Punch press	49
Grinder	46
Welder (machine)	45
Heat treater	44
Painter	41

Factor III (15.9%)	
Purchasing agent	92
Sales, building	80
Sales, equipment	79
Secretary	67
Clerk	60
Foreman	57
Metal fabricator	53
Stockman	51
Inspector	45
Heat treater	42

Factor IV (4.3%)	
Drop hammer	77

Factor V (4.1%)	
Cupola tender	62

Factor VI (4.0%)	
Packager	67

Factor VII (4.0%)	
Truck driver	57
Boilermaker	43

highest scores were generally on the physical behavior items.

A business cluster formed Factor III in the metal working analysis. The occupations in this cluster scored at a low level on most of the physical and discriminative behavior items. Except for items dealing with machine operation the occupations in the cluster scored at an average or higher level on behaviors in the intellectual, responsibility and decision making, and communication areas.

The skilled and semi-skilled clusters were differentiated primarily in terms of level. The patterns of scores of occupations in these clusters were very similar except that the skilled cluster had consistently higher scores than the semi-skilled cluster.

The business cluster was differentiated from the skilled and semi-skilled clusters quite clearly. The business cluster had generally lower scores on the physical and discriminative behavior items than the other two clusters. On the other hand, the business cluster generally scored higher than the other clusters on the intellectual, responsibility and decision making, and communication behaviors.

In terms of curricular implications it would appear that training curricula for the skilled and semi-skilled clusters would be quite similar except in terms of level of skill expected. This would imply that the curriculum for the skilled occupations would be lengthier than one for the semi-skilled occupations. This is likely an essential differentiation in the training for occupations in these clusters now. In many cases the semi-skilled occupations are essentially entry occupations and the incumbent progresses to the skilled level by apprentice, on-the-job, or further vocational training.

The occupations in the business cluster are distinctly different from those in the other clusters in terms of the behaviors measured by this instrument. A curriculum for the business cluster would concentrate on management and communicative behaviors with little emphasis on physical or discriminative behaviors.

As was mentioned earlier in the discussion of the agriculture clusters, the behaviors measured by this instrument are not definitive of the specific knowledge and skills required for specific occupations.

Combined Analysis

In the next analysis the 47 agriculture and 36 metal working jobs were analyzed together. This analysis was done on the matrix of correlations between the 83 jobs. It was decided to drop the D^2 analysis because it did not seem to yield any significantly different results in the previous analyses.

The 83 x 83 correlation matrix was omitted because it was highly redundant with the earlier matrices. The principal axis solution was carried to 20 factors which accounted for 91.1 per cent of the variance of the matrix. Ten factors, accounting for 84.6 per cent of the variance, were rotated. The four factors which had more than two loadings greater than .40 are presented in Table 18.

The four factors accounted for 76.6 per cent of the variance and in fact the first three accounted for 71.8 per cent of the variance.

The first factor was interpreted as a general industrial occupation factor. The differentiation between semi-skilled and skilled levels, apparent in the analysis of metal working occupations, did not obtain in this analysis. Factor IV might be interpreted as a skilled level occupation factor but this factor is quite weak. Factor II was clearly a business or personal contact factor and Factor III was a clear production agriculture factor. Thus this analysis did not result in a differentiation between agriculture and metal working occupations except that production agriculture occupations again emerged as a clear occupational cluster. Generally the industrial and the business occupations clustered together regardless of the industry.

The results of this analysis were indicative of an undesirability of including too many occupations in an analysis. With too many occupations it is possible that this clustering procedure becomes too gross and obviates meaningful clusters. The results suggest that a prior intuitive clustering is desirable to select the occupations to be studied and thus perhaps eliminate the gross clustering observed in this analysis.

A discussion of the characteristic behaviors of the clusters obtained in this analysis follows.

Common Behaviors in Combined Analysis

When the 83 occupations were analyzed together the factor structure was somewhat different from that obtained in the separate

Table 18

Significant Factors from Varimax Rotation of Factor Analysis of Correlation Matrix of 83 Occupations

Factor I (34.8%)		Factor I (cont.)		Factor II (19.8%)		Factor III (17.2%)	
Chopper operator	88	Cupola tender	69	Partsman	83	Fruit farmer	85
Punch press opr.	85	Mechanic	67	Sales, equipment	83	Grain farmer	82
Lathe operator	84	Boilermaker	67	Sales, feed	83	Cattle rancher	81
Drill press opr.	84	Tool & die	66	Sec. & cleri. (ag.)	80	Cattle feeder	79
Forklift	84	Packager	65	Sales, building	78	Hog grower	78
Tree trimmer	83	Heat treater	63	Sales, farm equipment	77	General farmer	78
Assembler	83	Drop hammer	63	Clerk (metal)	75	Dairy farmer	78
Painter	83	Mechanic	63	Auctioneer	75	Poultry farmer	77
Mill mach. opr.	82	Pattern maker	63	Sales, petroleum	71	Vegetable farmer	77
Ranch hand	81	Hatchery worker	62	Secretary (metal)	69	Golf course supt.	64
Welder (mach.)	81	Grain elevator wkr.	61	Buyer	68	Sheep grower	61
Grinder	80	Sale barn yardman	61	Stockman	67	Heavy equip. opr.	60
Truck driver	79	Brand inspector	60	Sales, fertilizer	62	Flower grower	54
Crane operator	79	Ditch rider	59	Veterinarian aid	59	Greenskeeper	54
Pellet mill opr.	78	Ag. technician	58	Nursery	59	Custom operator	53
Metal pourer	77	Metal fabricator	57	Grain elevator	57	Foreman	50
Farm hand	77	Nursery	56	Artif. breeding tech.	55	Ditch rider	50
Brake operator	77	Tractor operator	55	Flower grower	53	Farm hand	49
Welder	77	Clerk	53	Inspector	51	Sales, fertilizer	48
Food process.	76	Custom operator	53	Soil tester	51	Mechanic (ag)	45
Shear mach.	76	Veterinarian aid	53	Soil conserv. tech.	50	Metal fabricator	45
Cannery work	75	Inspector	52	Sheep grower	47	Groundskeeper	45
Molder	74	Greenskeeper	49	Metal fabricator	47	Blacksmith	44
Groundskeeper	73	Blacksmith	47	Brand inspector	46	Herdsman	42
Feed mill	73	Soil tester	43	Packager	46	Nursery worker	42
Truck driver	73	Soil conserv. tech.	43	Heat treater	45	Sales, farm equip.	42
Lumber yard man	72	Secretary (metal)	43	Sale barn yardman	45	Ag. technician	41
Sheet metal	72	Artif. breeding tech.	41	Hatchery worker	45		
Machinist	72			Lumber yard man	42		
				Foreman	41		

Table 18
(continued)

Factor IV (4.8%)

Tool & die	58
Pattern maker	56
Herdsman	49
Mechanic	49
Machinist	48
Mechanic (metal)	48
Soil tester	47
Blacksmith	47
General farmer	40

analysis. The scores of the occupations in the four clusters are presented in columns seven, eight, nine, and ten of Table 13. The first factor was labeled an industry cluster. The occupations in this cluster were generally those occupations in the agriculture industry and the metal working semi-skilled clusters. Generally the occupations in this cluster scored at a low average or low level on the behavioral items. Within the cluster the highest scores were on the physical and discrimination behavior areas. The only intellectual item with equally high scores was the knowledge of machine operation item. The remaining items had quite low scores.

The second factor defined a business cluster and included such occupations from the business clusters of the previous analyses. The occupations in this cluster had low average or average scores on the physical and discriminative behavior items with four exceptions; finger movement, near visual discrimination, estimation of quality, etc., and color discrimination. Average or high scores were obtained by the occupations in this cluster on the intellectual, responsibility and decision making, and communication behaviors with four exceptions; knowledge of machine operations, knowledge of machine assembly, visualization, and hand signals.

Production agriculture occupations defined the third factor in this analysis. The occupations in this cluster scored at an average or high level on all of the items. The intellectual and the responsibility and decision making items generally had the highest scores in this cluster. Certain discriminative behaviors also had high scores; color, sound, blind positioning, and monitoring. The physical and communicative behaviors were generally exhibited at an average level.

The fourth factor in the analysis was made up of skilled or perhaps technical level occupations. The occupations in this cluster scored generally at an average or high level on the items. The exceptions on which low scores were obtained were the estimation of speed, knowledge of business procedures, form policy, make work assignments, hand signals, persuasive communication, and personal service items also had quite low scores. The high scores for this cluster were on finger movement, assembly, hand tool, near visual discrimination, sense of touch, math usage, knowledge of machine operation, knowledge of machine assembly, read and interpret, close concentration, and reasoning items. The behaviors on this cluster seemed to define a rather high level but independent kind of occupation.

The curricular implications of this analysis are quite interesting. The analysis certainly does not help to resolve the question of the appropriateness of ag related training curricula. Whereas the analysis of the agricultural occupations did offer evidence to suggest that the vocational agriculture curriculum might be a useful basis for training workers in agriculture industry and agri-business occupations, this analysis presents somewhat different implications. The occupations in the agriculture industry and agri-business clusters apparently exhibited more commonality of behavior with industrial or business occupations in metal working than with production agriculture occupations. This result is, of course, only with respect to the behaviors measured by the instrument used in the study. It should be kept in mind also that any curriculum that would provide training in all of the behaviors exhibited by the production agriculture cluster would likely be a very generalizable curriculum.

There is probably no single curriculum pattern that will be completely satisfactory for these clusters nor any reasonable one that will be a complete failure. Certainly more additional work needs to be done on commonality of other types of behaviors across occupations before clear curricular patterns can emerge. On the basis of the results of the analyses in this study, the investigators believe that team teaching approaches would be desirable in developing curricula for agriculture industry and agri-business occupations. If such are not possible, however, the results do suggest that with certain modifications that might be made in existing vocational agriculture programs these programs can provide appropriate educational and training activities for agriculturally related occupations.

Other Analyses

Several additional analyses were made to study further certain aspects of the method.

One matter of interest and concern with the method of clustering was the question of the clusters that would be obtained if the analysis were to be based on a single interview for each job title. This, of course, is of importance in evaluating the method from an economics point of view.

In order to check the kinds of clusters that would obtain from single interviews two sets of single interviews were selected from the occupations. Thus we obtained two sets of 47 agriculture interviews with each set having a single interview per occupational title. Among the metal working occupations we selected two sets of 29 interviews with each set consisting of one interview per occupational title.

A matrix of correlations between the occupations was computed for each set and one of the agriculture and one of the metal working sets combined. Table 19 contains the rotated factors obtained from the two sets of agriculture interviews. It can be seen in the table that more clusters were obtained when the analysis was based on individual interviews.

This result was not unexpected in that the single interview from one occupation would exhibit different patterns of commonality with other occupations than when occupation scores were based on a number of interviews. The factor patterns actually illustrate the well-known fact that the behavior of one person in an occupation does not well define the behavior typical of that occupation.

On the other hand there was a reasonable degree of congruence between the results presented in Table 19 and the results from the analysis based on more than one interview per occupation. Factors IA and B were very similar to the agriculture industry factor observed in the first analysis. The production agriculture factor of the first analysis split into two factors in the analysis of single occupations (Factor IIA and B and IIIA and B). (Factor IIA seemed to have a sizeable agriculture industry component as well.) The agriculture business or personal contact factor showed up as a single factor in one of the single interview analysis (Factor IVB) and as two factors in the other (Factors VA and VIA). The other factors in the single interview analyses seemed to result from the uniqueness of a specific worker in a job and were difficult to interpret.

The larger number of factors from the individual interview analysis was also evident in the metal working occupations. The factors of the two analyses are presented in Table 20.

The first three factors in the individual interview analyses were very similar to those found in the earlier analysis of metal working occupations. In each instance there was a semi-skilled, skilled, and business or personal contact factor. The high loading for painter on Factor IA above, however, illustrates the point of the instability of factors based on individual interviews. Evidently this painter behaved in many ways as a business worker and was not really typical of most painters.

The remaining factors in the analyses of individual interviews were again probably due to unique behaviors of the particular worker whose interview was used.

Table 19

Significant Factors from Varimax Rotations of Factor Analyses of Two Sets of Individual Ag Interviews

Factor IA (18.5%)		Factor IB (20.3%)		Factor IIA (10.8%)		Factor IIB (11.8%)	
Truck driver	82	Chopper operator	86	Cattle rancher	73	Cattle feeder	81
Chopper operator	79	Tree trimmer	81	Mechanic	69	Poultry farmer	74
Pellet mill opr.	78	Farm hand	79	Custom operator	67	Hog grower	68
Ranch hand	77	Dairy plant worker	73	Land leveler	63	Sheep grower	67
Tree trimmer	76	Hatchery worker	69	Herdsman	54	Custom operator	64
Farm hand	70	Land leveler	69	Cattle feeder	53	Cattle rancher	63
Feed mill opr.	67	Lumber yard man	66	Dairy plant worker	52	Grain farmer	52
Greenskeeper	66	Sale barn yardman	66	Vegetable farmer	52	Fruit farmer	46
Cannery worker	66	Cannery worker	65	Soil tester	44	Vegetable farmer	43
Brand inspector	61	Ditch rider	64	Sheep grower	43	Livestock buyer	43
Rod man	56	Groundskeeper	64	Poultry farmer	41	Veterinarian aid	42
Dairy plant worker	56	Ag. technician	64			Greenskeeper	40
Lumber yard man	54	Feed mill opr.	63				
Sale barn yardman	52	Truck driver	60				
Sales, petroleum	48	Pellet mill opr.	59				
Groundskeeper	48	Brand inspector	51				
Ag. technician	45	Mechanic	48				
Mechanic	44	Sales, feed	47				
Hatchery worker	41	Clerical	43				
		Sales, equipment	42				

Factor IIIA (10.0%)		Factor IIIB (10.9%)	
Flower grower	77	General farmer	77
Fruit farmer	66	Golf course supt.	65
Ditch rider supt.	60	Herdsman	64
Vegetable farmer	55	Dairy farmer	62
Groundskeeper	50	Ranch hand	61
Hog grower	50	Fruit farmer	51
Dairy farmer	50	Vegetable farmer	50
Grain farmer	49	Greenskeeper	48
Sales, equipment	46	Sales, fertilizer	45
		Nurseryman	45
		Cattle rancher	44

Table 19
(continued)

Factor IVA (7.4%)	
Veterinarian aid	69
Elevator worker	65
Artif. breed. tech.	58
Sale barn yardman	53
Soil tester	49
Sheep grower	43

Factor IVB (9.9%)	
Sales, petroleum	77
Partsman	73
Sales, feed	67
Sales, equipment	56
Ranch hand	54
Veterinarian aid	51
Rod man	45
Clerical	45
Sales, fertilizer	44
Nurseryman	43

Factor VA (5.8%)	
Golf course supt.	64
Auctioneer	61
Cattle feeder	57
Sales, feed	50
Herdsman	45
Feed mill operator	44

Factor VB (4.9%)	
Flower grower	77
Artif. breed. tech.	64

Factor VIA (5.3%)	
Partsman	74
Sales, feed	51
Sales, equipment	46
Lumber yard man	43
Rod man	42

Factor VIB (4.1%)	
Auctioneer	72
Fruit farmer	46

Factor VIIA (4.9%)	
General farmer	64
Dairy farmer	53
Hatchery worker	50
Poultry farmer	50
Ag. technician	44

Factor VIIB (3.6%)	
Rod man	49
Pellet mill opr.	48
Buyer	45

Factor VIIIA (4.0%)	
Livestock buyer	62
Ag. technician	49

Factor VIIIB (2.5%)	
Elevator worker	43

Factor IXA (2.9%)	
Sales, petroleum	55
Sales, fertilizer	48

Factor IXB (2.5%)	
Mechanic	51

Table 20

Significant Factors from Varimax Rotations of Factor Analyses of Two Sets of 29 Individual Metal Interviews

Factor IA (17.6%)		Factor IB (20.3%)		Factor IIA (15.8%)		Factor IIB (16.8%)	
Painter	81	Forklift	82	Forklift	82	Pattern maker	84
Purchasing agent	79	Truck driver	78	Crane operator	76	Machinist	76
Salesman	75	Painter	73	Truck driver	65	Drill press	64
Clerk	72	Lathe operator	71	Shear operator	60	Blacksmith	58
Sales	71	Siding installer	64	Welder	55	Assembler	50
Sales, building	65	Crane operator	61	Lathe operator	51	Purchasing agent	48
Secretary	52	Stockman	59	Punch press	50	Tool & die	48
Siding inst.	52	Milling mach.	53	Brake operator	47	Crane operator	47
Inspector	44	Punch press	50	Drill press	47	Milling mach.	46
		Auto. weld.	47	Assembler	45	Sheet metal	43
		Welder	46	Milling mach.	45	Welder	43
		Molder	41			Punch press	42

Factor IIIA (14.9%)		Factor IIIB (13.4%)		Factor IVA (8.4%)		Factor IVB (9.5%)	
Machinist	73	Sales	81	Stockman	74	Shear operator	71
Tool & die	70	Sales, building	81	Auto. welder	55	Brake operator	63
Milling mach.	66	Salesman	69	Assembler	54	Tool & die	51
Drill press	65	Purchasing agent	64	Brake operator	42	Assembler	43
Molder	54	Clerk	61			Sheet metal	43
Lathe operator	52	Secretary	51				
Welder	47						
Pattern maker	43						
Siding inst.	43						

Factor VA (7.0%)		Factor VB (6.5%)		Factor VIA (5.9%)		Factor VIB (3.9%)	
Blacksmith	70	Inspector	73	Inspector	55	Secretary	55
Sheet metal	58	Punch press	53	Pattern maker	51	Welder	50
Punch press	44			Heat treater	47		
Secretary	42						

The factor loadings of the analysis based on one set of 47 agriculture occupations and one set of 29 metal working occupations combined are presented in Table 21.

The results of this analysis were very similar to the results of the combined analysis reported earlier. In both analyses there was a clear industrial worker, business or personal contact, and production agriculture cluster. The remaining factors in the individual interview analysis were of slight significance.

On the basis of these results, it was concluded that clusters based on individual interviews of incumbents lacked the stability of clusters based on more than one intervi w per occupation. On the other hand, it was also concluded that clusters obtained from individual interviews were meaningful and, with good judgment, could be used to name clusters and identify behaviors associated with a cluster. It appeared the largest factors (i.e., those with several occupations with high loadings) did represent meaningful clusters.

Clustering by Interview and by Judgment

Another matter of interest was to compare the method of clustering used in this project with one that would be based on judgments of persons knowledgeable about the occupations.

In this analysis 20 agriculture and 20 metal working occupations were selected. A correlation matrix was computed and factor analysis was conducted for each set of 20.

The 20 occupations in each set were also judged by a group of people in terms of their similarity. Twenty-five vocational agriculture teachers judged the 20 agriculture occupations and sixteen Trade and Industry teachers judged the 20 metal working occupations. The T and I teachers were teachers of some metal working occupation.

The judgments were made in the form of a multi-dimensional scaling technique (Torgerson, 1958). The judge was instructed to rank the degree of similarity of each occupation to a criterion occupation. The judge ranked the occupations 20 times; each time a different one of the 20 occupations was used as the criterion. Thus in each judgment one of the occupations was made the criterion and the judge ranked the other 19 in terms of similarity to the criterion. A relative distance matrix was derived from the judgment matrices. The relative distance matrix was a matrix indicating relative distance among the occupations. An estimate of absolute distance was obtained by adding a constant to each value in the relative distance matrix. The additive constant was estimated from

Table 21

Significant Factors from Varimax Rotation of Factor Analysis of Correlation Matrix of 47 Ag. and 29 Metal Individual Interviews*

Factor I (26.5%)	
Chopper operator	85
Lathe operator	81
Tree trimmer	80
Dairy plant worker	80
Forklift operator	79
Assembler	78
Shear operator	78
Milling mach. opr.	77
Brake operator	77
Welder	77
Hatchery worker	76
Lumber yard man	75
Sale barn yardman	70
Farm hand	69
Punch press operator	67
Auto. welder	67
Land leveler	67
Pellet mill opr.	66
Feed mill opr.	66
Ditch rider	66
Cannery worker	66
Ag. technician	65
Truck driver	64
Groundskeeper	63
Brand inspector	63
Drill press operator	62
Crane operator	61
Stockman	60
Truck driver (metal)	60

Factor I (cont.)	
Sales, feed	57
Tool & die	54
Clerical (ag)	52
Molder	52
Machinist	52
Soil conserv. tech.	50
Artif. breeding tech.	49
Sales, farm equipment	48
Sheet metal worker	48
Painter	47
Mechanic (ag)	44
Nurseryman	42
Secretary (metal)	42

Factor II (11.0%)	
Partsman	77
Painter	74
Purchasing agent	73
Salesman (metal)	72
Salesman	70
Clerk	66
Livestock buyer	61
Sales manager	56
Sales, petroleum	55
Veterinarian aid	54
Soil conserv. tech.	51
Auctioneer	50

Factor II (cont.)	
Elevator worker	49
Sales, farm equip.	44
Clerical (ag)	44
Siding installer	44
Secretary (metal)	40

Factor III (10.6%)	
Poultry farmer	73
Cattle rancher	72
Hog grower	69
Cattle feeder	69
Vegetable farmer	65
Greenskeeper	61
Custom operator	59
General farmer	58
Dairy farmer	55
Golf course supt.	54
Sales, fertilizer	49
Sheep grower	49
Grain farmer	44
Ranch hand	42

Factor IV (5.1%)	
Herdsman	66
Ranch hand	58
Mechanic (ag)	56
Blacksmith	52
Nurseryman	48

Factor V (4.6%)	
Pattern maker	56
Molder	50
Sheep grower	48
Heat treater	43
Inspector	43
Mechanic (ag)	43
Tool & die	42
Cannery worker	41

Factor VI (2.5%)	
Flower grower	77
Artif. breeding tech.	50
Grain farmer	40

the largest relative distances (Torgerson p. 276). The matrix of absolute distances was converted to a scalar products matrix which was factor analyzed with the principal axis procedure and the factor matrix was rotated to the varimax criterion.

The multi-dimensional scaling approach described here was expected to yield occupational clusters based on judged similarity among occupations. Obviously if clusters can be formed by judgment, this would be a more economical approach than using interviews. It should be made clear that a comparison of the two methods in no way indicates that one is right and the other wrong or that either is better.

The multi-dimensional scaling approach was attempted late in the project. Despite several attempts, factor analyses of the various scalar products matrices did not yield interpretable results. The problem seemed to result from the estimation of the constant added to the relative distance matrix to get the absolute distance matrix. Work will continue on this problem by us.

With the difficulty encountered above, it was decided to attempt an analysis of the judgments using an approach similar to the D^2 approach described earlier. A D^2 matrix was computed by squaring the difference between ranks for each job and summing across subjects. The matrix was then transformed to a matrix in which the cell entries were a percentage of agreement based on the largest ΣD^2 in the matrix. It was reasoned that a factor analysis of this matrix would reveal a pattern of agreement in the judged similarity of the jobs or, in fact, the clusters that would be formed by judgment. The judgment clusters in Tables 22 and 23 were obtained by this method.

The factors obtained from the interview data and from the teacher judgments for the 20 agriculture occupations are presented in Table 22.

Twenty of the 47 agricultural occupations were used for this analysis. Only 20 were selected because the judging task is quite difficult and tedious. The 20 occupations were selected to cover a variety of agricultural jobs. When the 20 were selected, a job title was selected at random from the titles grouped in an occupation. In most cases the job title corresponded closely with the occupational title. The two notable exceptions were the job title of meat cutter taken from the food processing occupations and the job title of fruit sorter from the cannery occupations. The job titles were used for the judging procedure.

Table 22

Occupational Clusters Obtained by the Interview Schedule and by Judgment on 20 Agricultural Occupations

Instrument Clusters

Factor I		Factor II		Factor III	
Fruit grower	89	Cannery worker	83	Partsman	80
Cattle rancher	87	Food proces. worker	81	Feed salesman	78
General grain and livestock farmer	87	Truck driver	81	Equipment salesman	76
Grain farmer	87	Feed mill operator	78	Fuel salesman	70
Vegetagle grower	86	Custom operator	59	Produce buyer	66
Dairy farmer	84	Nursery worker	56		
Poultry grower	81				
Greenskeeper	61				
Custom operator	55				
Nursery worker	52				

Clusters from Judgments

(The loadings on the jobs on the factors in this analysis cannot be interpreted as correlations. They are presented only to indicate relative strength.)

Factor I		Factor II		Factor III		Factor IV	
Fruit grower	95	Equipment salesman	94	Dairy farmer	82	Meat cutter (Food proc. worker)	91
Nurseryman	92	Partsman	93	General grain and livestock farmer	76	Hog buyer (Produce buyer)	83
Fruit sorter (Cannery worker)	90	Fuel salesman	87	Grain farmer	71	Artif. breeding tech.	62
Greenskeeper	89	Feed salesman	71	Poustry grower	71	Truck driver	51
Vegetable grower	89	Custom operator	69	Rancher	67	Rancher	50
Grain farmer	55	Truck driver	55				

A comparison of the two sets of clusters in Table 22 indicates both similarity and difference between the two clustering procedures. Factor III from the instrument analysis and Factor II from the judgment analysis correspond quite well, and both suggest an agri-business cluster. The other factors in the two analyses, however, seem to indicate a different basis for clustering between the two methods. In the instrument analysis, the production agriculture and agriculture industry clusters were again quite obvious. The three remaining factors in the judgment analysis, however, suggest that the clusters were formed on the basis of product the individual works with rather than on job behaviors. Thus in the judgment analysis, Factor IV appears to consist of agriculture occupations that deal primarily with animals and Factor I appears to be a cluster of horticulture type occupations. Factor III might be interpreted as a cluster of occupations in which crop production is involved.

The data in Table 22 do indicate that different methods of clustering can be expected to result in somewhat dissimilar clusters. Whereas the instrument used in the study clustered occupations on the basis of behaviors, it would appear that vocational agriculture teachers would cluster occupations more on the basis of the product knowledge required in the job. That neither set of clusters is correct nor wrong is obvious, and this result should increase our cognizance of the likelihood that any occupation might cluster with others in various ways depending on the basis for the clustering.

The metal working occupation clusters formed by the two methods are presented in Table 23.

The results of the two methods of clustering metal working occupations also showed similarities and differences. In general the jobs in Factors I and II of both analyses are similar, but the arrangement is such to suggest somewhat different bases for clustering. Factor I on the instrument analysis seems to be a skilled worker cluster and Factor II a semi-skilled cluster. Factor I in the judgment analysis appears to be a machine operator cluster and Factor II more of a skilled cluster. A metal fabrication cluster and a cluster of occupations in which heat is a factor were differentiated by the judgment method while these clusters did not show up at all in the instrument analysis. The business factor showed up as a doublet in both analyses.

The results of the two comparisons do indicate that occupations can be clustered meaningfully on the basis of judgment. Such clusters will not necessarily be the same as those that might be

Table 23

Occupational Clusters Obtained by the Interview Schedule and by Judgment on 20 Metal Working Occupations

Instrument Clusters

Factor I		Factor II		Factor III		Factor IV	
Tool and die	86	Forklift operator	78	Packager	77	Building sales	87
Mechanic	83	Crane operator	72	Lathe operator	51	Secretary	50
Machinist	81	Punch press opr.	66				
Sheet metal worker	75	Molder	62				
Molder	69	Power brake opr.	53				
Power brake opr.	66						
Milling mach. opr.	65						
Metal fabricator	64						
Drill press opr.	64						
Welder	60						
Assembler	58						
Boilermaker	57						
Lathe operator	56						
Punch press opr.	50						

Judgment Clusters

Factor I		Factor II		Factor III		Factor IV	
Forklift	84	Tool and die	87	Sheet metal worker	73	Arc welder	85
Punch press operator	82	Milling mach. opr.	70	(Metal fabrication)		Heat treater	76
Hydraulic press opr. (Packager)	80	Machinist	67	Sheet metal shop	63	Molder	57
Drill press opr.	79	Arc welder	56	Boilermaker	63	Boilermaker	50
Power-brake opr.	78	Lathe operator	52	Mechanic	61		
Molder	76					**Factor V**	
Lathe operator	75					Stenographer	91
Assembler	68					Building salesman	85
Mechanic	64						
Machinist	56						
Milling mach. opr.	55						
Crane operator	52						
Sheet metal shop	50						

obtained by some other method such as by scales and check lists. Which procedure is correct is not evident, and , in fact, no procedure is likely to be the correct one.

Further Discussion of the D Statistic

Although we discontinued performing any analyses with the D statistic after the first two analyses, this did not mean that we were no longer interested in it. In some respects the D statistic and especially the hierarchical grouping procedure employed by the Air Force seem to us to be very useful approaches to clustering. One obvious advantage is that one violates few assumptions about scale properties with the D statistic and certainly the correlation approach we used violate many assumptions. We intended to apply the hierarchical grouping to our data and still do, but we were not able to program this procedure for our computer in the time schedule of the project.

As we worked with the D statistic and the factor analysis of the matrix derived from it we recognized a possible source of bias in the factor structure that came out. The values in the D" (derived) matrix were based on the largest obtained difference among the occupations in the matrix. If the largest difference were really quite small in relation to the largest possible difference, then, the values in the D" matrix would infer differences between the occupations to be much larger than they actually were. In other words the D" matrix values were relative to the largest D value and not relative to some constant. Thus if the D" matrix had been constructed so that the values were relative to the largest possible difference, the values would reflect a high degree of similarity among the occupations.

A comparison of the results of using different bases for computing the D" matrix was possible in an analysis that we performed. Twenty agriculture occupations were used. A D" matrix was derived on the basis of the largest D value among the jobs which was 490. A second D" matrix was then derived based on the maximum D value possible, 7,679. The matrix based on 490 is presented in Table 24 and the matrix based on 7,679 is presented in Table 25. The matrices differ considerably.

Both matrices were then factor analyzed and ten factors extracted. Five factors from each factor matrix were then rotated. The results of these rotations are presented in Table 26.

Obviously there are differences, but also some similarities. There was a very strong general factor that emerged in the analysis

Table 24

Difference Matrix of 20 Ag Occupations Based on Largest D in Matrix

1.																			
2.	63																		
3.	54	80																	
4.	63	58	68																
5.	74	76	74	77															
6.	44	72	75	58	67														
7.	39	17	09	23	44	01													
8.	62	47	36	43	59	24	66												
9.	58	36	29	38	56	16	71	74											
10.	72	77	71	64	79	62	40	68	61										
11.	71	57	49	54	74	36	56	64	76	76									
12.	71	54	39	67	75	36	44	57	60	70	77								
13.	59	50	39	54	68	40	62	64	69	66	73	72							
14.	68	67	55	55	72	54	53	67	65	78	68	65	64						
15.	76	61	53	67	81	47	67	77	81	78	86	84	86	77					
16.	60	28	16	40	55	10	68	68	77	51	70	73	78	54	86				
17.	37	48	35	37	61	34	01	15	19	65	59	61	39	50	55	23			
18.	54	58	52	58	76	50	30	39	41	69	64	70	65	63	71	50	73		
19.	67	58	52	64	77	47	28	47	46	72	71	78	63	62	76	58	70	81	
20.	54	40	39	55	62	21	00	13	25	57	63	69	38	39	57	29	67	50	60

Table 25

Difference Matrix of 20 Ag Occupations Based on Maximum D Value Possible

1.																			
2.	97																		
3.	97	99																	
4.	97	97	98																
5.	98	98	98	98															
6.	96	98	98	97	93														
7.	96	94	94	95	96	93													
8.	97	96	96	96	97	95	98												
9.	97	96	95	96	97	94	98	98											
10.	98	98	98	98	99	97	96	98	97										
11.	98	97	96	97	98	96	97	98	98	98									
12.	98	97	96	98	98	96	96	97	97	98	98								
13.	97	97	96	97	98	96	97	98	98	98	98	98							
14.	98	98	97	97	98	97	97	98	98	98	98	98	98						
15.	98	97	97	98	99	96	98	98	99	98	99	99	99	98					
16.	97	95	94	96	97	94	98	98	98	97	98	98	98	97	99				
17.	96	96	95	96	97	95	93	94	94	98	97	97	96	97	97	95			
18.	97	97	97	97	98	97	95	96	96	98	97	98	98	97	98	97	98		
19.	98	97	97	97	98	96	95	96	96	98	98	98	97	97	98	97	98	99	
20.	97	96	96	97	97	95	93	94	95	97	97	98	96	96	97	95	98	97	97

Table 26

Significant Factors from Varimax Rotation of Factor Analyses of 20 Ag Occupation D'' Matrices
(A was based on D = 490 and B was based on D = 7,679)

Factor Ia

Grain farmer	89
Fruit farmer	88
General farmer	87
Vegetable farmer	82
Cattle rancher	76
Dairy farmer	73
Groundskeeper	65
Poultry farmer	57
Farm hand	55
Ag. technician	52
Flower grower	45
Sales, equipment	43

Factor IB

Grain farmer	82
General farmer	80
Fruit farmer	80
Vegetable farmer	78
Dairy farmer	75
Cattle rancher	75
Groundskeeper	73
Farm hand	71
Poultry farmer	71
Ag. technician	71
Flower grower	68
Sales, equipment	67
Food processing worker	67
Chopper operator	66
Sales, petroleum	65
Truck driver	63
Livestock buyer	62
Feed mill worker	62
Sales, feed	60
Partsman	59

Factor IIA

Sales, food	88
Partsman	88
Livestock buyer	80
Sales, equipment	60
Flower grower	59
Sales, petroleum	58
Poultry farmer	53
Ag. technician	44

Factor IIB

Partsman	64
Sales, feed	63
Livestock buyer	60
Sales, petroleum	54
Sales, equipment	53
Flower grower	53
Poultry farmer	52
Ag. technician	50
Vegetable farmer	49
Chopper operator	48
Food processing worker	47
Cattle rancher	46
Dairy farmer	45
Feed mill worker	45
Groundskeeper	44
Truck driver	43
Fruit farmer	43
Farm hand	43
Grain farmer	42
General farmer	39

Table 26
(continued)

Factor IIIA

Feed mill worker	87
Chopper operator	74
Food processing wk.	59
Flower grower	44
Farm hand	42

Factor IIIB

Feed mill worker	64
Truck driver	63
Food processing worker	57
Chopper operator	56
Farm hand	55
Sales, equipment	51
Sales, petroleum	51
Groundskeeper	51
Flower grower	50
Ag. technician	48
Livestock buyer	48
Cattle rancher	48
Sales, food	47
Partsman	47
Dairy farmer	46
Poultry farmer	46
General farmer	44
Fruit farmer	40
Vegetable farmer	38
Grain farmer	36

Factor IVA

Truck driver	89
Farm hand	56
Ag. technician	56
Sales, petroleum	51
Groundskeeper	46
Food processing wk.	42
Feed mill worker	41
Sales, equipment	41

based on D' derived from the maximum. Furthermore, the second and third factors were also quite general. In effect this outcome reflects a high degree of similarity among occupations and actually this is generally true. Occupational behaviors are human behaviors and thus similar across occupations.

The similarity between the two analyses was perceived on the basis of the occupations with the largest loadings on each factor. In the D" matrix based on the maximum D value the first factor was defined by production agriculture occupations, the second by business or personal contact occupations, and the third by agriculture industry occupations. The third factor in the analysis based on the maximum D seemed to be a combination of the third and fourth factors of the other analysis. Even though the occupations were highly similar in terms of behavior, there was sufficient uniqueness among certain of the occupations to define independent factors. It appeared, however, that the use of the maximum D value obscured some meaningful discrimination among the occupations.

The D statistic merits further study in our opinion. Perhaps there is an optimal value to use as the basis for the D" matrix such as the mean. We believe that it would also be possible to derive a random distribution of the D values obtainable from an instrument and then it would be possible to assign a probability of chance outcome to the similarity between occupations expressed by a specific D value.

SUMMARY AND CONCLUSIONS

The purpose of the study reported in this paper was to determine whether common behaviors could be identified across occupations. These common behaviors if identifiable could serve as a basis for curriculum building.

An average of between five and six interviews were conducted with incumbents in 47 agricultural occupations and 36 occupations in the metal fabricating industry. A total of 466 interviews were conducted with incumbents in these occupations in Colorado and Nebraska.

The interview schedule contained a number of general work environment items, a clerical check list, a physical activities check list, a personal contact check list, and a supervision level check list. In addition there were 42 items divided among five major behavioral dimensions: physical, discrimination, intellectual, responsibility and decision making, and communication behaviors. An incumbent's behavior on each of these items was scored on from four to seven scales depending on which were appropriate. The scales were variety, precision, frequency, importance, speed, strength, and complexity. The schedule yielded 312 separate scores for each interview. Not all of the scores were independent, however, because the scale scores on each of the 42 behavioral items were related in the sense that all of the scales on an item received scores or none of them did.

In addition to the 312 scores of the interview, the scores from the appropriate worker trait groups in the DOT were recorded for each interview. The inclusion of these scores resulted in 357 scores for each interview. Twenty-eight of the scores were subsequently dropped because 90 per cent or more of the interviews had the same score. One of the 42 behavior items, taste discrimination, was dropped from further analysis for this reason.

The 329 scores for each interview were the data used in the various analyses of the study. Three principal axis factor analyses were done on various combinations of variables in the data matrix. The varimax rotations of these analyses yielded factors which indicated that the interview schedule was measuring several meaningful common behaviors.

The basic procedure for identifying common job behaviors was to factor analyze the correlation matrix based on intercorrelations among the occupations. A mean score was computed on each of the 329 variables for the 83 occupations. These mean scores were then correlated. The correlation matrices for the 47 agricultural occupations and for the 36 metal working occupations were each analyzed by the principal axis method. A third analysis was made of the 83 x 83 matrix of the correlations among all of the occupations. The factor matrices were rotated to the varimax criterion.

Another analysis procedure was tried. This analysis was based on a matrix derived from difference scores among the occupations. The results of these analyses were very similar to the results obtained from the analyses of the correlation matrices.

The analysis of the correlation matrix of the 47 agriculture occupations yielded three factors. These factors were interpreted as occupational clusters and the interpretation of the clusters were quite clear. The first cluster was characterized by high loadings of production agriculture occupations and was so named. The second cluster was made up of occupations in agricultural industry, and the third cluster was an obvious agri-business cluster.

To identify the behaviors that characterized a cluster, a tally was made of the number of occupations in a cluster that scored above or below the mean of all the occupations on each variable. It was assumed that a large number of scores above the mean would indicate a high level of that behavior, an equal split would indicate an average level, and a large number of low scores would indicate a low level of behavior.

Using this procedure the production agriculture cluster was characterized by an average or high level on nearly all of the behaviors. The highest levels, however, were on intellectual and responsibility and decision making behaviors.

The agriculture industry generally scored at a low average or low level on most of the behaviors. The highest scores for the occupations in this cluster were on behaviors associated with the operation of machines.

The agri-business cluster occupations scored at a generally high level on intellectual, responsibility and decision making, and communicative behaviors. The scores in this cluster were generally low on the physical and discriminative behaviors.

The analysis of the 36 metal working occupations also yielded three factors which were identified as skilled worker, semi-skilled worker, and business clusters. The pattern of scores for the skilled worker and the semi-skilled worker clusters were quite similar except that the skilled cluster tended to score at a higher level. The highest scores for the occupations in these clusters were generally on the physical and discriminative behavior items. The occupations in these clusters tended to score at a low level on all of the behaviors when compared with the other occupations.

The business cluster in the metal working industry exhibited a pattern of scores similar to that observed with the agri-business cluster.

When the 83 occupations were analyzed together, four factors emerged. The factors were defined as an industrial worker cluster, a business cluster, a production agriculture cluster, and a technical or skilled worker cluster.

The occupations in the industry cluster scored at a low average or low level on most of the items. The highest scores for this cluster were on the physical and discriminative behaviors and on behaviors associated with knowledge of machines. The occupations in this cluster were primarily from the agriculture industry factor and the semi-skilled metal worker cluster.

The business cluster was made up of occupations from the business factors identified in the two previous analyses. The scores in this cluster were highest on the communication, intellectual, and responsibility and decision making behaviors.

The production agriculture cluster in this analysis was nearly identical with the production agriculture cluster in the agricultural analysis. The highest scores were observed on the intellectual and responsibility and decision making behaviors.

The fourth factor was identified as a skilled or technical cluster. The occupations in this cluster scored high on behaviors associated with rather independent types of work situations. The occupations in this cluster scored at a considerably higher level on most behaviors than the industrial occupations. There were some notably low scores, however, on items such as policy making, knowledge of business procedures, and the communication behaviors.

A comparison was made of the clusters obtained by the analysis of interview responses and clusters based on judgment. The results of these comparisons indicated that in agriculture the clusters obtained from the analysis of the instrument were somewhat different from clusters based on judgments of similarity by vocational agriculture teachers. Whereas the instrument yielded clusters based on job behaviors, it appeared that the teachers were discriminating among the jobs on the basis of product knowledge. The comparison of the two methods in the metal working occupations indicated that the clusters based on the instrument analysis were very similar to clusters based on judgments of job similarity made by T and I teachers.

It was felt that the results of the project did offer some curricular implications. The occupational clusters that were identified were reasonable, and the scoring pattern of the occupations in a cluster on the behavioral items were suggestive of different emphases that would be provided for in a curriculum for the cluster.

Recognizing a current mild controversy in vocational education regarding the curriculum for agriculture related occupations, the results of this study did little to resolve this controversy. Two clear clusters of ag related occupations emerged and these were distinct from the production agriculture cluster. The pattern of scores on the production agriculture cluster, however, was such that a curriculum designed to provide comprehensive work in production agriculture would seemingly cover well the behaviors in the other clusters also. On the other hand, the ag industry and agri-business occupations did exhibit more commonality with industrial and business occupations in the metal working industry than with production agriculture occupations. Certainly more evidence is needed on this question than this study provided. Obviously the behaviors measured in this study did not cover all of the knowledge and understanding that might also serve to cluster or differentiate occupations. The results of the study did suggest that a team teaching approach would serve well in a curriculum for training for placement in ag industry and agri-business occupations.

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APPENDIX

B. PRECISION Scales:

#1 Precision of Mathematics Usage and Judgment:
1. Rough approximations are acceptable.
2. Relatively accurate estimates are acceptable.
3. Exactness is a primary consideration in itself.

#2 Precision of Application of Knowledge:
1. Must use only general knowledge of major features.
2. Must use detailed knowledge of major features.
3. Must use comprehensive knowledge which includes small details.

#3 Precision of Interpretation:
1. Only a general outline is involved.
2. A number of specific major features are involved.
3. Exactness and attention to details are primary considerations.

#4 Precision of Physical Movements:
1. Movements are gross or simple and require very little control.
2. Control of movements is important and requires moderate care or effort.
3. Care with which movement is made is of primary importance in itself. Requires a great deal of care and effort.

#5 Precision in Discrimination:
1. Only a few gross features must be noted.
2. Noting a number of major features is important and requires moderate care or effort.
3. Extremely fine features or graduations must be noted which requires a great deal of care and effort.

C. FREQUENCY Scale:

1. Hourly - Typically will do it at least once per hour.
2. Daily - Typically will do it at least once per day.
3. Weekly - Typically will do it at least once per week, but less often than daily.
4. Semi-monthly - Typically will do it at least once in a two week period.
5. Monthly - Typically will do it at least once in a four week period.
6. Intermittently - Typically a behavior that is not performed regularly. At certain times it may be performed frequently and then the incumbent may not do it for a considerable period of time.
7. Other - Specify on line provided.

D. IMPORTANCE of this job aspect or skill:

1. This aspect or skill is not of primary importance, but is handy to have.
2. This is an aspect or skill of equal importance as compared to most other aspects or skills required.
3. This is one of the most important aspects or skills required on my job.

E. SPEED with which this job aspect must be performed:

1. Speed is no consideration except that it must be performed within a reasonable length of time; ample time usually available.
2. It must be performed as quickly as possible to avoid waste of time or money but rigid deadlines or timed processes are not involved.
3. Speed itself is a primary consideration essential for productivity, safety, avoiding damage or carrying out timed processes.

F. STRENGTH required for physical movements:

1. Little strength is required to perform the activity with involved muscles. A ten-year old child would have enough strength in the muscles that are used.
2. It must be performed as quickly as possible to avoid waste of time or money but rigid deadlines or timed processes are not involved.
3. Speed itself is a primary consideration essential for productivity, safety, avoiding damage or carrying out timed processes.

F. STRENGTH required for physical movements.:

1. Little strength is required to perform the activity with involved muscles. A ten-year old child would have enough strength in the muscles that are used.
2. Requires as much strength in the muscles that are used as an adult usually has, without special training.
3. Requires more strength in the muscles that are used than the beginning worker has, but the necessary strength can usually be built up in a two-week period.
4. Requires an abnormal amount of strength in the muscles that are used either because of the extreme short term force or the endurance needed to perform the activity.

COLORADO STATE UNIVERSITY

and

UNIVERSITY OF NEBRASKA

Project No. 1603

Interviewer ____________________

Interviewee ____________________

Job Title ____________________

Company ____________________

Address ____________________

Date of Interview ____________________

Age of Interviewee ____________________

Sex of Interviewee ____________________

Length of time in
present occupation ____________________

QUESTIONS APPLYING TO THE WHOLE JOB

1. Education: Check the educational experiences that you have had.

____1. Less than High School

____2. High School

____3. Special Vocational Training in High School

____4. Special Vocational Training after High School--formalized

____5. On-the-job Training

____6. Apprenticeship

____7. Junior College

____8. College

____9. Other, specify

2. Supervision: How much supervision do you receive? (Check only the one that is most appropriate.)

____1. Do you perform individually assigned tasks under direct and relatively continuous supervision?

____2. Do you make up or regulate your own short term work schedule for a listed number of prescribed activities; receiving frequent periodic direct superivsion?

____3. Do you make up your own work schedule for extended periods from a fairly extensive number of prescribed activities; is your work reviewed periodically?

____4. Do you make up your own work schedule and determine when you will work and what you will do; do you require little or no supervision, working on your own initiative?

3. Repetitiveness: To what extent do you do the same thing over and over again every day? (check one)

____1. Very varied--activities vary greatly from day to day with little repetition of specific tasks. No one work day is exactly like another.

____2. Fairly varied--fairly wide variety of duties involving a number of different tasks. The job is not highly routinized.

____3. Fairly Repetitive--performs the same basic tasks from day to day, but there is some variation in order and scope.

____4. Highly Repetitive--performs essentially the same task many times over during a working day.

4. Work Environment: Which of the following statements best describes your work environment? (More than one item may be checked.)

____1. Personal inconvenience such as unusual working hours, extensive traveling, separation from family, frustrating experiences (such as handling complaints, frequent interruptions).

____2. Definite physical hazards such as dangerous chemicals, machinery, high voltage wires, heavy lifting.

____3. Uncomfortable working conditions such as extreme temperatures, vibrations, noxious fumes, dust, dirt, noise.

____4. Work environment has no unusual aspects.

5. Regularity of Job? Does this job provide continuous employment at all times? (More than one item may be checked.)

____1. The nature of the job changes, but there is continuous employment (e.g., the nature of activities depends on crop being harvested).

____2. This job is strictly seasonal in nature.

____3. One can expect periodic lay-offs on this job due to weather, seasonal changes in production schedules.

____4. This job provides continuous employment at all times.

6. Technical vocabulary: Do you use any words on your job that the ordinary person wouldn't understand, such as names of tools, processes, or machines.

____1. No special terms.

____2. Only a few technical terms.

____3. Limited technical vocabulary.

____4. Extensive technical vocabulary.

7. Does your job require vision under special conditions, such as under conditions of reduced illumination or through special equipment such as goggles, helmets?

____1. Yes

____2. No

8. Is there any special kind of background that it would be desirable for a person to have in order to work on a job like yours?

____

____

____

Physical Activities: These activities involve body and limbs. Some of the tasks performed on a job require a combination of mental and physical activities. Please respond to the following items, however, only on the basis of the physical aspects of the activity and consider only those activities that are a requirement of the job rather than being incidental to it, such as walking around the office.

P1 A. Name the different ways finger movements are used on job as distinguished from gross arm and hand movements. (e.g., typing vs. filing; setting points on a car vs. using a wrench).

B. Precision #4: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you make these finger movements?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important is it that you be able to make these finger movements? 1 2 3

E. Speed: How much speed is required in your finger movements? 1 2 3

F. Strength: How much strength is required for these finger movements? 1 2 3 4

G. Complexity: 1 2 3 4

P2 A. Name the different ways you control or manipulate relatively large objects through hand and arm movements. (e.g., candling an egg; filing papers, using a wrench).

B. Precision #4: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you use arm-hand movement?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important is arm-hand movement on your job? 1 2 3

E. Speed: How much speed is required in these arm-hand movements? 1 2 3 4

F. Strength: How much strength is required for these arm-hand movements? 1 2 3 4

G. Complexity: 1 2 3 4

P3 A. Name the different activities which require special use of feet and legs. (e.g., operation of pedals).

B. Precision #4: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you make these foot-leg movements?

____ 1 2 3 4 5 6 7

D. Importance: How important are foot-leg movements on your job? 1 2 3

E. Speed: How much speed is required in these foot-leg movements? 1 2 3

F. Strength: How much strength is required? 1 2 3 4

G. Complexity: 1 2 3 4

P4 A. Name the different activities you perform which require simultaneous coordination of two or more limbs and/or senses. (e.g., driving a car, typing).

B. Precision #4: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you use this coordination?

____ 1 2 3 4 5 6 7

D. Importance: How important is coordination of this type on your job? 1 2 3

E. Speed: How much speed is required in these coordinated movements? 1 2 3

F. Strength: How much strength is required in these coordinated activities? 1 2 3 4

G. Complexity: 1 2 3 4

P5 A. Name the different ways you engage in general bodily activity. By this I'm referring to the overall use of the body and limbs, as would be found in heavy work, such as loading a boxcar or moving a side of beef.

B. Precision #4: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you engage in some general body activity directly related to your job?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important is it that you be able to engage in general body activity? 1 2 3

E. Speed: How much speed is required in the general body activities required of you? 1 2 3

F. Strength: About how much strength is required? 1 2 3 4

G. Complexity: 1 2 3 4

P6 A. Name the different motor control operations you perform on your job? (the extent to which you are required to operate one or more "hand control" devices such as knobs, cranks, levers, wheels, handles, etc. in operating machinery).

B. Precision #4: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you engage in control activities?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important are these control activities? 1 2 3

E. Speed: How much speed is required in these control activities? 1 2 3

F. Strength: How much strength is required: 1 2 3 4

G. Complexity: 1 2 3 4

P7 A. Name the different things you have to assemble? (the type of activity as would be found in overhauling a motor; rebuilding a carburetor).

B. Precision #4: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you assemble things?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important is this assembly activity? 1 2 3

E. Speed: How important is speed in the assembling you do? 1 2 3

F. Strength: How much strength would you say is needed in the assembling you do? 1 2 3 4

G. Complexity: 1 2 3 4

P8 A. Name the different hand tools you use on your job? (any tool which you hold and manipulate with one or both hands like a hammer or wrench).

B. Precision #4: What degree of precision is required (when using these tools?) 1 2 3

C. Frequency: How frequently do you use hand tools on your job?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important is it that you know how to use these tools? 1 2 3

F. Strength: How much strength is required to use these tools? 1 2 3 4

G. Complexity: 1 2 3 4

Discrimination: This area is concerned with activities in which you must use various senses to note characteristics of things, differences between things or changes in things.

D1 A. Name the different ways or situations in which you must note the characteristics of objects and/or differences between objects within arm's reach. (e.g., inspects watch parts; makes entries on sales tickets; reads small dials and guages).

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you engage in this activity?

_______________________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is the noting of these characteristics or differences? 1 2 3

E. Speed: How important is speed when you are making note of these characteristics or differences? 1 2 3

G. Complexity: 1 2 3 4

D2 A. Name the different ways or situations in which you must note the characteristics of objects or differences between objects beyond arm's reach. (e.g., watches highway signs and reads them while driving truck).

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you have to engage in this activity?

_______________________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is the noting of these characteristics of differences? 1 2 3

E. Speed: How important is speed when you are making note of these characteristics or differences? 1 2 3

G. Complexity: 1 2 3 4

D3 A. Name the different ways you use depth discrimination. (Judging the distance of an object or the distance relationship between objects.)

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently is depth discrimination called for on your job?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is your ability to make depth discriminations? 1 2 3

E. Speed: How important is speed in making these depth discriminations? 1 2 3

G. Complexity: 1 2 3 4

D4 A. Name the different ways you must estimate the speed of objects in relation to other moving objects or to a fixed point (e.g., estimating speed of conveyor belt; estimating speed of moving car).

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you make these estimates of speed?

____ 1 2 3 4 5 6 7

D. Importance: How important is it that you be able to make these estimates of speed? 1 2 3

E. Speed: How important is the speed with which you make these estimations? 1 2 3

G. Complexity: 1 2 3 4

D5 A. Name the different ways you must estimate quality (or value), quantity, or size?

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you make these estimations?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is making these estimations? 1 2 3

E. Speed: How important is speed in making these estimations? 1 2 3

G. Complexity: 1 2 3 4

D6 A. Name the different situations in which you have to tell the difference between colors. (e.g., blending colors; identifying color coded wires).

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you tell the difference between colors?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is it that you be able to tell the difference between colors? 1 2 3

E. Speed: How important is speed when you are trying to tell the difference between colors? 1 2 3

G. Complexity: 1 2 3 4

D7 A. Name the different ways or situations in which you must identify or hear differences in sounds in terms of their intensity, frequency, or other characteristics. (e.g., tuning an engine, listening to pitch of saw during a cutting operation).

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you tell the difference between sounds?

_______________________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is it that you be able to tell the difference between sounds? 1 2 3

E. Speed: How important is speed when you are trying to tell the difference between sounds? 1 2 3

G. Complexity: 1 2 3 4

D8 A. Name the different ways or situations in which you must note the difference between odors, such as discriminating between perfumes or checking for leaking gas?

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you tell the difference between odors?

_______________________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is it that you be able to tell the difference between odors?

1 2 3

G. Complexity: 1 2 3 4

D9 A. Name the different ways or situations in which you must tell the difference between things by taste.

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you tell the difference between tastes?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is it that you be able to tell the difference between tastes? 1 2 3

D10 A. Name the different situations or ways in which you must identify or judge objects with the sense of touch. (e.g., feeling for smoothness of sanded board; choosing tools by "touch").

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you make decisions of some type on the basis of the sense of touch?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is your ability to make decisions based on the sense of touch? 1 2 3

G. Complexity: 1 2 3 4

D11 A. Name the different ways you must move a body member from one specific position to another solely from "the feel of it" and without the use of vision. (e.g., stepping on a brake pedal; reaching for a control lever, putting a nut on a bolt in a place where you can't see what you're doing).

B. Precision #4: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you make a movement of this type?

____ 1 2 3 4 5 6 7

D. Importance: How important is it that you be able to make these types of movements? 1 2 3

E. Speed: How important is speed in making these movements? 1 2 3

G. Complexity: 1 2 3 4

D12 A. Name the different work processes you have to monitor? By this I'm referring to frequently or continuously checking a process in operation to see that it is functioning satisfactorily, or to identify certain stages in the process. (e.g., check temperature guages on boiler; check steel to see if it's ready for next stage of processing).

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you check a process in operation?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is the checking of ongoing processes? 1 2 3

E. Speed: How important a factor is speed in monitoring? 1 2 3

G. Complexity: 1 2 3 4

Intellectual Activities: This area is concerned with the mental abilities and knowledges required for the performance of the job. Consider only those mental activities that are actually related to the job rather than being incidental to it.

I1 A. Name the different ways you use math? (e.g., any use of numbers or equations).

B. Precision #1: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you have to use math?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is the use of math? 1 2 3

E. Speed: How important is it that you are fast in the use of math? 1 2 3

G. Complexity: 1 2 3 4

I2 A. What machines do you have to know how to operate?

B. Precision #2: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you have to utilize your knowledge of operating these machines?

____ 1 2 3 4 5 6 7

D. Importance: How important to your job is the knowledge of operating these machines? 1 2 3

G. Complexity: 1 2 3 4

I3 A. Name the different machines for which you have to have a knowledge of how they are put together and their mechanical operations?

B. Precision #2: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you have to use your knowledge of how these machines are put together?

____ 1 2 3 4 5 6 7

D. Importance: How important is it that you know how these machines are put together? 1 2 3

G. Complexity: 1 2 3 4

I4 A. Name the characteristics you have to know about the finished product? (e.g., how used, cost).

B. Precision #2: Must you have detailed knowledge? 1 2 3

C. Frequency: How frequently do you have to use this knowledge?

____ 1 2 3 4 5 6 7

D. Importance: How important is it that you know these characteristics about the finished product? 1 2 3

G. Complexity: 1 2 3 4

I5 A. What do you have to know about the characteristics of materials that go into the finished products? (e.g., strength and life expectancy of parts).

B. Precision #2: Must you have detailed knowledge? 1 2 3

C. Frequency: How frequently do you have to use this knowledge?

____ 1 2 3 4 5 6 7

D. Importance: How important is it that you have this knowledge? 1 2 3

G. Complexity: 1 2 3 4

I6 A. Name the different processes you must be familiar with? (e.g., steps payroll goes through; how to grow a particular crop).

B. Precision #2: Must you have detailed knowledge? 1 2 3

C. Frequency: How frequently do you have to use this knowledge?

____ 1 2 3 4 5 6 7

D. Importance: How important is it that you know these processes? 1 2 3

G. Complexity: 1 2 3 4

I7 A. What business procedures must you be familiar with? (e.g., principles of marketing, bookkeeping).

B. Precision #2: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you use business procedures?

____ 1 2 3 4 5 6 7

D. Importance: How important is it that you know these business procedures? 1 2 3

G. Complexity: 1 2 3 4

I8 A. What type things must you read and interpret? (e.g., plans, bulletins, specifications, technical publications).

B. Precision #3: What degree of precision is required? 1 2 3

C. Frequency: How frequently must you read and interpret information like this?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is it that you read and interpret this type of information? 1 2 3

G. Complexity: 1 2 3 4

I9 A. Name the instructions and directions, oral and/or written, that you must follow. (e.g., letters, memos, directives).

B. Precision #3: What degree of precision is required (general or specific instructions)? 1 2 3

C. Frequency: How frequently are you called upon to follow instructions or directions?

______________________________ 1 2 3 4 5 6 7

G. Complexity: 1 2 3 4

I10 A. What are the situations where you have to visualize the relationship of things that cannot be observed directly? (e.g., blueprint reading, size estimations).

C. Frequency: How frequently must you visualize things?

D. Importance: How important is it that you be able to visualize things? 1 2 3

G. Complexity: 1 2 3 4

I11 A. Name the things you have to closely concentrate on? (e.g., threading a needle, adding a column of figures).

C. Frequency: How frequently do you engage in tasks requiring concentration?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important is it that you be able to do tasks requiring concentration? 1 2 3

G. Complexity: 1 2 3 4

I12 A. Name the different ways you must reason or engage in problem solving? (e.g., fixing a broken machine; deciding on a process).

C. Frequency: How frequently must you engage in problem solving or reasoning?

____ 1 2 3 4 5 6 7

D. Importance: How important is it that you do this? 1 2 3

E. Speed: How important is speed in your problem solving? 1 2 3

G. Complexity: 1 2 3 4

Responsibility and Decision Making: This area is concerned with activities in which you must make decisions or assume responsibilities.

R1 A. In what ways are you responsible for formulation and execution of policies and/or goals (e.g., establishing intra-department routines, determining quotas).

B. Precision #3: What degree of precision is required? 1 2 3

C. Frequency: How often do you perform the above tasks?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job are the above tasks? 1 2 3

R2 A. What work assignments do you make to personnel and/or machines?

B. Precision #3: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you make work assignments?

____ 1 2 3 4 5 6 7

G. Complexity: 1 2 3 4

R3 A. In what situations are you responsible for developing budgets and forecasting the need for personnel, material, and/or money (e.g., developing departmental budget).

B. Precision #1: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you develop budgets or forecast upcoming needs?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is this activity? 1 2 3

G. Complexity: 1 2 3 4

R4 A. Name the different situations or ways you inspect for quality and/or quantity of work compared to a standard (e.g., accepts or rejects finished product, decide when crop is ready for market).

B. Precision #5: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you perform some inspection task?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is inspection?

G. Complexity: 1 2 3 4

R5 A. What parts or materials are you responsible for ordering or buying?

B. Precision #1: What degree of precision is required? 1 2 3

C. Frequency: How often do you order parts or materials?

____ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is ordering? 1 2 3

G. Complexity: 1 2 3 4

Communications and Interpersonal Relationships: This area is concerned with the extent to which you give and receive information and interact with other people as a requirement of your job.

C1 A. Name the different situations you have to speak to individuals or groups about information pertinent to their jobs (e.g., giving instructions to worker).

B. Precision #3: What degree of precision is required (general or specific conversations)? 1 2 3

C. Frequency: How frequently do you have to talk to others in regard to their work?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is this activity? 1 2 3

G. Complexity: 1 2 3 4

C2 A. Name the different types of written communications such as reports, letters, memos, etc. that you originate?

B. Precision #3: What degree of precision is required? 1 2 3

C. Frequency: How frequently do you originate written communications?

______________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is this activity? 1 2 3

G. Complexity: 1 2 3 4

C3 A. Name the ways or situations in which you must communicate by other than oral or written means (e.g., hand signals).

C. Frequency: How frequently do you communicate in this way?

_______________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is this type of communication? 1 2 3

G. Complexity: 1 2 3 4

C4 A. Name the different situations in which you engage in some type of persuasive communication? (e.g., sales pitch, mediate disputes).

C. Frequency: How frequently do you engage in persuasive communication?

_______________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is making persuasive communications? 1 2 3

G. Complexity: 1 2 3 4

C5 A. Name the different ways you provide some type of personal service such as waiting on people or providing goods or services?

C. Frequency: How frequently do you provide personal service?

_______________________________ 1 2 3 4 5 6 7

D. Importance: How important a part of your job is providing personal service? 1 2 3

E. Speed: How important is it that you be fast in providing this personal service? 1 2 3

G. Complexity: 1 2 3 4

G1 Indicate the importance of the following activities in terms of the scale given below.

0. Definitely not part of this position, does not apply, or is not true.
1. Under unusual circumstances may be a minor part of the position.
2. A relatively unimportant part of the position.
3. A part of the position.
4. A substantial part of the position.
5. A most significant part of the position.

____A. Files (letters)
____B. Typewriting
____C. Takes dictation in shorthand
____D. Operates calculating or adding machine
____E. Operates bookkeeping machine
____F. Does bookkeeping by hand
____G. Takes inventory
____H. Operates duplicating machine
____I. Acts as receptionist
____J. Other clerical activities, specify

G2 Of the people listed below, check those with whom you have contact on your job. Check only those with whom you have direct contact regarding your job, and not a person that you may casually see during the working day.

____A. Members of Management - Those people who supervise individuals who in turn supervise others (e.g., executives).

____B. Foremen and other First Line Supervisors - Those people who supervise non-supervisory personnel (e.g., foremen, office managers).

____C. Non-Supervisory Personnel - Normally considered to be skilled, semi-skilled or unskilled occupations not including clerical or sales (e.g.,electrician, machine operator).

____D. Clerical Workers - (e.g., typists, file clerk).

____E. Salesmen - (e.g., sales clerks, door-to-door salesmen. Do not include sales managers)

____F. Semi-Professional and Professional Personnel - (e.g., draftsmen, chemists).

____G. Customers - Including clients, patients, etc.

____H. "The Public" - Not included as customers or any of the other classifications (e.g., people who might communicate with "The Public" would be publicity manager, policemen, newscasters).

____I. "Important Persons" - (e.g., visiting dignitaries).

____J. Prospective Employees

____K. Students or Trainees - (Includes only people in formal situations).

____L. Investors

____M. Suppliers

____N. Others - specify

G3 Check each of the following items that apply to you on your job.

____1. I supervise or review or inspect the work of others and may issue directives.

____2. I monitor the work of individuals or groups in order to coordinate my own work and/or the work of others.

____3. I have final responsibility for hiring some or all personnel.

____4. I have final responsibility for dismissing some or all personnel.

____5. I have final responsibility for changes in personnel status and/or pay (e.g., promotions, demotions, changes in work assignments).

____6. I develop work schedules for individuals and/or groups.

____7. I regulate my own work flow, deciding when to speed up or slow down.

____8. I regulate others' work flow deciding when they are to speed up and/or slow down.

____9. I am responsible for the physical safety of others.

____10. I make major decisions which can have a permanent effect on the company.

____11. My job requires walking.

____12. My job requires jumping.

____13. My job requires running.

____14. My job requires balancing.

____15. My job requires climbing.

____16. My job requires crawling.

____17. My job requires standing.

____18. My job requires stooping.

____19. My job requires crouching.

____20. My job requires kneeling.

____21. My job requires sitting.

____22. My job requires reaching.

____23. My job requires lifting.

____24. My job requires carrying.

____25. My job requires throwing.

____26. My job requires pushing.

____27. My job requires pulling.

____28. My job requires handling.

____29. My job requires fingering.

____30. I am paid by regular salary.

____31. I am paid by the hour.

____32. I am paid by the piece.

____33. I am paid by the job or contract.

____34. I am paid by commission.

____35. I am paid by tips.

____36. I am self-employed, dependent upon net profit.

____37. I am paid by another means, which is __________.

____38. The way I dress is left up to me.

____39. I am expected to wear a tie and jacket or other publically presentable clothing during working hours.

____40. I am required to wear a specific uniform during working hours.

____41. Because of the nature of the work, I usually wear working clothes such as denim overalls, etc.

____42. Because of the safety factors, I usually wear, or am required to wear, special clothing or apparel.