

Effects of Job Familiarity and Level of Analysis
on Analyst Importance Ratings of Relevant
Knowledges, Skills and Abilities

by

Laura Ferri Donnelly

Thesis submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE
in
Psychology

APPROVED:

David A. Bownas, Chairperson

B. von Haller Gilmer

Stephen J. Zaccaro

November, 1983
Blacksburg, Virginia

EFFECTS OF JOB FAMILIARITY AND LEVEL OF ANALYSIS
ON ANALYST IMPORTANCE RATINGS OF RELEVANT
KNOWLEDGES, SKILLS AND ABILITIES

by

Laura Ferri Donnelly

(ABSTRACT)

This study was conducted to determine the effects of analyst job familiarity on the accuracy of job analysis information. Differences in job analysis information resulting from differences in the specificity of job information units chosen for analysis were also examined. Students having no prior direct experience with one of three jobs -- secretary, firefighter, or power plant operator -- rated the importance of abilities, both job-specific and general, for successful performance of this job. These three jobs varied in terms of general familiarity associated with them, as determined in a pilot study. In addition, this study compared the accuracy of secretary ability importance ratings for three groups of students differing in their familiarity with the job of secretary. Test scores on the General Aptitude Test Battery were weighted by both student and expert ability importance weights to determine whether rating differences between the two job analysis sources would influence selection decisions.

Accuracy did vary as a function of job familiarity, with secretary ratings being more accurate than firefighter or power plant operator ratings. Importance ratings for specific abilities were more accurate than those for general abilities. The patterns of predicted performance in weighted GATB scores using student and expert weights were quite similar, although there were mean differences between the two weighting strategies. It is suggested that criterion-referenced selection decisions may vary depending on an analyst's job familiarity, whereas decisions based on norm-referenced measurement would probably not.

ACKNOWLEDGEMENTS

Many people contributed to the preparation of this thesis. I would like to extend my utmost appreciation to Dr. David Bownas, who provided assistance in many ways. In addition to being a delight to work with, his seemingly infinite store of knowledge was always generously offered. I would also like to thank Dr. Steve Zaccaro, Dr. H. von Haller Gilmer and Dr. H. John Fernardin for their support and guidance.

In the data collection phase of this project, I relied on the expertise and good nature of many individuals. In particular, I would like to thank Gail Ford of the U. S. Army Corps of Engineers, and John Kuhn and Steve C'Quinn of the Virginia Employment Commission for their invaluable assistance.

My family has played an important role throughout my education; I would like to express my appreciation for their encouragement and support. Finally, the patience and encouragement of my husband, Ed, who provided help in so many ways, are deeply appreciated.

TABLE OF CONTENTS

ABSTRACT	ii
ACKNOWLEDGEMENTS	iv
 <u>Chapter</u>	 <u>page</u>
INTRODUCTION	1
Background	1
Job analysis agents and information sources	2
Statistical concerns	7
Job analysis units	9
Job analysis in terms of required abilities	11
Job analyst familiarity with jobs	14
Summary	15
Hypotheses	17
PILOT STUDY	20
METHOD	22
Subjects	22
Measures	22
Criterion Scores	23
Procedure	25
ANALYSES	27
Specific abilities	27
General (GATB) abilities	29
Analyses of familiarity differences within the secretary job	30
Effects for Ability Specificity	32
Predicted Performance: Student vs. Expert Ability Weights	32
RESULTS	35
Specific abilities	35
General (GATB) abilities	38
Effect for Familiarity within the Secretary Job	42
Effects for Ability Specificity	47
Comparison of Predicted Performances	54

DISCUSSION	57
----------------------	----

REFERENCES	69
----------------------	----

<u>Appendix</u>	<u>page</u>
-----------------	-------------

A. PILOT STUDY FAMILIARITY QUESTIONNAIRE	72
--	----

B. FIREFIGHTER ABILITY RATING FORM	74
--	----

C. POWER PLANT OPERATOR ABILITY RATING FORM	80
---	----

D. SECRETARY STUDENT ABILITY RATING FORM	89
--	----

E. SECRETARY EXPERT ABILITY RATING FORM	95
---	----

F. SECRETARY FAMILIARITY QUESTIONNAIRE	102
--	-----

G. ANALYSIS OF VARIANCE SUMMARY TABLES	104
--	-----

VITA	108
----------------	-----

LIST OF TABLES

<u>Table</u>	<u>page</u>
1. Summary of T-Test Results for Familiarity Data . . .	21
2. Analysis of Variance Summary Table for Tau Correlations between Student and Expert Ratings of Specific Abilities	36
3. Analysis of Variance Summary Table for Tau Correlations between Student and Expert Ratings of General (GATB) Abilities	39
4. Analysis of Variance Summary Table for Tau Correlations between Student and Expert Ratings of General (GATB) Abilities	40
5. Analysis of Variance Summary Table for Accuracy across Familiarity and Ability Level for the Secretary Job	44
6. Analysis of Variance Summary Table for Accuracy across Familiarity and Ability Level for the Secretary Job	45
7. Tau Means and Standard Deviations for Within- Secretary Study	48
8. Analysis of Variance Summary Table for Accuracy across Job and Ability Level	49
9. Analysis of Variance Summary Table for Accuracy across Job and Ability Level	50
10. Summary Results for Comparisons of Predicted Performance	55

LIST OF FIGURES

<u>Figure</u>	<u>page</u>
1. Interaction of Job with Ability Level	52
2. Interaction of Job with Ability Level	53

INTRODUCTION

This thesis evaluates whether the familiarity which job analysts have with the jobs they analyze influences their estimates of the abilities required to perform these jobs. If so, the next question becomes whether decisions about who should be hired are affected by these differences. In addition, this study examines the degree to which the accuracy of job analysis information depends on the specificity level of the abilities used to analyze jobs.

BACKGROUND

The comparability and adequacy of job-related information obtained from different sources is a question of great importance to personnel psychologists. Results of research directed at this issue have been mixed. Studies have varied the individual or agent providing the information (e.g., incumbent vs. supervisor) as well as the means by which the information is obtained (e.g., direct observation vs. reading job descriptions). In addition, the kind of job information obtained and thus the unit of analysis varies from study to study.

Job analysis agents and information sources

Regarding conclusions about different agents of job information, McCormick and Tombrink (1960) reported that "supervisors and incumbents show no systematic differences in consistency in reporting information about incumbents' work" (cited in Morsh, 1964, p. 12). In their study, information about tasks performed by incumbents was solicited. Morsh (1964) concluded that exploratory comparisons of supervisory interview data with incumbent inventory responses revealed only minor discrepancies in the information provided about incumbents' jobs.

Other researchers, however, have found substantial discrepancies in the information obtained from different agents. When foremen's and general foremen's perceptions of the responsibilities of the foreman position were compared, Meyer (1959) found considerable disagreement. O'Reilly (1973) reported that four-fifths of the supervisors in his study of clerical jobs incorrectly judged their subordinates' job responsibilities. These judgments simply required indicating whether or not certain tasks were performed by the worker. Further discrepancies were found when the two groups estimated the level of skill/knowledge required to perform a given task satisfactorily. Thus, perceptions of both the tasks performed and the skill

requirements of subordinates' jobs differed between supervisors and incumbents.

Similarly, Hazel, Madden and Christal (1964) found large discrepancies between supervisor and incumbent judgments of tasks performed by the worker, as well as in estimates of the relative proportion of time the worker spent on each task performed. Agreement in ratings of which tasks were performed was higher (57% agreement, 94 supervisor-worker pairs) than agreement about time-spent estimates (48% agreement, 94 pairs). These researchers performed an additional analysis, determining the amount of agreement for time-spent ratings when examined at the level of duties (i.e., groups of tasks). As might be expected, agreement was much higher at this more general level, with 73% agreement, as compared to 48% agreement at the more specific task level. There was no tendency for workers to exaggerate either the number of tasks they performed or the difficulty level of these tasks, and means for both groups were comparable. Hazel et al. concluded that supervisors may lack the precise knowledge of their subordinates' jobs and are thus unable to provide accurate information about tasks performed by workers. As noted, however, supervisors' reports on the broader duties performed by workers were considerably more accurate. In addition, Hazel et al.

speculated that supervisors may provide accurate task information when identifying tasks performed by a group of subordinates, a question which their study could not address since each supervisor based his estimates on only one worker.

Smith and Hakel (1979) held the kind of analysis information constant, examining the degree of convergence among various data sources using the Position Analysis Questionnaire (PAQ) (McCormick, Jeanneret & Mecham, 1972). The PAQ analyzes jobs in terms of "worker-oriented" job elements, characterizing each job in terms of certain generalized human behaviors. In this study, job incumbents, supervisors, personnel technicians experienced in job analysis, and two groups of college students were the analyst sources. Built into this comparison of data sources was a variety of the means by which information about the jobs was obtained. Incumbents and supervisors relied on their implicit knowledge of the job; the means by which personnel technicians gained knowledge of the jobs was unspecified; one group of students was presented with only job titles; and the final group of students was given "job specifications", which included descriptions of the nature and illustrative examples of the work, but excluded any information on the knowledges, skills, abilities and qualifications required by the job.

Smith and Hakel found no significant differences among the five judge categories in terms of reliability. All validities, determined by using the data from each of the five groups to predict salary, were statistically significant, with no significant differences among the five judge categories. There was a tendency for supervisors and incumbents to demonstrate relative leniency in the use of the rating scales, rating all or most KAC items higher than did the analysts. The researchers' major conclusion was that "aside from the question of leniency in responding, the source of responses of a job analysis inventory makes little practical difference" (p. 691).

Cornelius and Lyness (1980), primarily interested in a comparison of alternative judgment strategies for making overall evaluations of jobs, noted one finding which is pertinent here. They reported that job analyst ratings and the average ratings from incumbents within a job for the thirteen job analysis scales being rated were similar. However, they too found that job incumbents, as compared to job analysts, tended to inflate ratings on some job analysis scales.

A recent study by Jones, Main, Butler and Johnson (1982) investigated narrative job descriptions as information sources for job analysis ratings. Four graduate

students, none of whom had previously worked in a health care environment, rated detailed narrative descriptions of 121 hospital jobs using the PAQ. Interrater agreement for job dimension scores based on these ratings was acceptable, with a median intraclass correlation of .70 and an average pairwise correlation of .83 for the five overall job dimensions. The 121 job categories were cluster analyzed on the basis of their scores on the job dimensions. Results suggested that "the ratings were sufficiently sensitive to essential similarities and differences among the various job categories to produce conceptually meaningful higher order clusters" (p. 825). These researchers concluded that ratings from accurate narrative descriptions provide a reliable and valid basis for many organizational applications, including setting pay and establishing the generalizability of selection and training programs.

In a study by Trattner, Fine and Kulis (1955), worker requirement ratings made by professional "occupational analysts" after reading job descriptions were compared to ratings based on direct observation. Since all analysts rated jobs on ten aptitude factors which were then included in the GATB, both the unit of analysis and the analysis agent were held constant. Results indicated a satisfactory degree of both self-consistency and consistency with

objective test data, as well as a "high degree of correspondence between the mean ratings made by the two groups" (p. 191). This suggests that ratings were not dependent on the source of job information, either direct observation or reading job descriptions.

Statistical concerns

Recently, Burt (1980) reexamined literature bearing on the interchangeability of information provided by different job analysis agents. A major conclusion from these studies is that whether data support rater similarity or not depends on the statistics applied to them. In his 1980 study, he had four types of raters (supervisors, incumbents, students provided with a job description, and students given only a job title) complete the PAQ for the job of power plant operator. Correlations between mean profiles for all groups were significant at the .05 level, and the correlation between supervisory and incumbent mean profiles was .98. However, applying a one-way multivariate analysis of variance (MANOVA) to these data indicated large differences among the four groups ($p < .0001$). A one-way MANOVA applied to only the supervisory and incumbent ratings also resulted in significant differences ($p < .001$).

In a conceptual replication, Burt (1983) again pointed to the importance of the chosen statistics in reaching conclusions about the equivalence of supervisors and incumbents as job analysis sources. Analysts in this study used the Job Inventory Checklist, a job analysis instrument similar to the PAQ, which was developed for the American Petroleum Institute. Supervisors and incumbents rated several jobs within one job family of the petrochemical industry. Correlational analysis indicated that supervisor and incumbent ratings were significantly similar, $r = .98$ ($p < .0001$); multivariate analyses showed them to be significantly different ($p < .0013$). In sum, Burt cautions that the predominant use of correlational analysis to measure profile similarity is inappropriate. This, he notes, calls into question previous researchers' (e.g., Smith & Hakel, 1979) conclusions concerning the equivalence of different job analysis agents.

Burt's demonstrations of both significant rating agreement and significant rating disagreement points to underlying differences in what correlational and multivariate tests are designed to measure. That is, correlation assesses only profile similarity, without being influenced by the overall mean difference between two profiles. Multivariate strategies, such as multivariate

analysis of variance and Hotelling's T-square, are sensitive to both similarity of profile shape as well as elevation differences between two rating vectors. Smith and Hakel's (1979) conclusion that the validities of various sources of job analysis information were equal implies that rating profile shapes were similar, but makes no statement concerning mean differences among profiles. To assess equivalence of ratings among the data sources in terms of both profile shape and elevation, Burt's (1980, 1983) conclusions suggest that multivariate strategies should be used. Multivariate analysis of variance would have allowed these researchers to take into account supervisor and incumbent rater leniency tendencies to which Smith and Hakel referred.

Job analysis units

There are few studies which directly compare job analyses performed using different kinds of job analysis data. Job analyses which vary on this aspect may focus on different types of job characteristics, such as general attributes of jobs, human traits or abilities necessary for successful performance, specific task-oriented data, job-oriented elements (i.e., elements which describe what is accomplished by the worker), or worker-oriented elements

(i.e., elements which describe what the worker actually does to accomplish work).

Cornelius, Carron and Collins (1979) examined the effects of various data types on job classification. Seven foreman jobs in a chemical processing plant were analyzed using the same hierarchical clustering procedure for each of three types of job analysis data: task-oriented, worker-oriented (PAQ), and abilities-oriented. For the PAQ data, a job analyst and at least one foreman incumbent from each job independently completed the form; both the task-oriented and the abilities-oriented data were based on consensus judgments from an analyst and foremen. Thus, the only comparison of different agents consisted of correlations between job incumbent and job analyst responses to the PAQ. Cornelius et al. reported a range of .38 to .72, with a median of .59 for these between-analyst correlations.

The average analyst ratings (for the PAQ data) or the consensus judgments (for the two other data types) were entered into a clustering program. Results of the three analyses revealed that both the number of clusters and the makeup of these clusters (i.e., which jobs were most similar) differed depending on the type of job analysis data used to compare the jobs. The researchers concluded that different job analysis models result in different job

classifications. They suggested that psychologists should develop a convincing rationale for the unit of work selected for analysis. The purpose for which the analysis is to be performed should be considered when choosing the unit of work to assure that the information obtained is appropriate for a specific organizational purpose. Prien and Ronan (1971) also stressed that the purpose of analysis influences the level of analysis which is selected. They note that the degree of specificity required in analyses varies depending on the use to which the information will be put. Such variation in purpose has been one factor influencing the development of different methods of job analysis.

Job analysis in terms of required abilities

One important purpose for conducting job analysis is to translate this information into a set of prerequisites for desirable job applicants. Obviously, requirements derived from the job analysis information are related to the units of work selected for study. When, for example, a job is analyzed in terms of the abilities necessary for successful performance, applicant qualifications may be defined in terms of performance on appropriate aptitude tests.

Recently, investigators have examined the question of validity generalization of aptitude tests for purposes of

employee selection. Schmidt and Hunter (1977) discussed a Bayesian statistical model which could examine whether the variation found in validity outcomes across studies of similar jobs and tests, and previously assumed to reflect true differences among jobs, was actually a statistical artifact. Empirical support for the model was found by Schmidt, Hunter, Pearlman and Shane (1979), calling into question the traditional belief that employment test validities are situation-specific. Further, Schmidt, Hunter and Pearlman (1981) demonstrated that task differences among jobs do not moderate the validity of aptitude tests in selection. They concluded that "fine-grained, detailed job analyses tend to create the appearance of large differences between jobs that are not of practical significance in selection" (p. 175). Therefore, they suggested job analysis methods which permit grouping jobs in terms of broad content structure or inferred underlying abilities as the "most appropriate and powerful techniques" (p. 175).

Schmidt (1979) has carried the above conclusions one step further. He has argued that an adequate job analysis can be prepared by an analyst who is unfamiliar with the job in question. The analyst, he maintains, need only observe an incumbent on the job for a relatively short period of time (e.g., one-half to one day), and by means of this

observation, the analyst can determine the abilities required for successful job performance. Once the necessary abilities have been identified, selection procedures can be employed which test for these abilities in job candidates.

Levine, Ash and Bennett (1980) similarly suggest that any analyst, provided he or she has knowledge of psychometrics, may be able to briefly study a job description, converse with a few incumbents and supervisors for a short while, and then "produce as good an exam battery" (p. 535) as that prepared after a costly, formal job analysis study.

Virtually no consensual support for this position exists in discussions of job analysis. Most authors recommend a combination of various techniques of job analysis to develop an effective analysis. Also, whereas Schmidt and his colleagues recommend broad methods of analysis, most authors suggest detailed, intensive methods. Bass and Barrett (1981), for example, suggest that several of the following techniques be used together: interview of employees and supervisors, observation of employees, actual performance of the job by the analyst, administration of questionnaires, and review of training materials.

Job analyst familiarity with jobs

Underlying most discussions of job analysis is the belief that some familiarity on the part of the analyst with the job in question is quite helpful, if not essential. McCormick (1979) contends that it is desirable for the analysts selected to have some familiarity with the jobs to be analyzed. If this is not possible, analysts should read relevant background material "about the industry in question, the processes with which the jobs are involved, and the organizational structure in which the jobs exist" (p. 32). Clearly, McCormick's suggestion rests on the assumption that the analyst's familiarity with a job is an important factor in performing an effective job analysis.

The U. S. Department of Labor, in its 1972 Handbook for Analyzing Jobs, also stresses that job analysis requires some degree of preparation. The analyst should first "become familiar with the technologies of the jobs and characteristics of the industry to be studied" (p. 11). A list of sources for this information is provided, including such materials as library books, other literature on technical or related subjects, and any job-related information already prepared by the establishment.

It should be noted that these authors discuss job analysis in general, often without distinguishing between

the different purposes for which it can be used, including organizational design, work and equipment design, and personnel administration (Cascio, 1982). In practice, these different uses can call for different kinds of analyses. Schmidt and his colleagues, by contrast, are solely interested in job analysis used for employee selection.

SUMMARY

In sum, the literature to date cannot answer the question of just how familiar people providing job analysis information need to be with the jobs they analyze. Research directed at this issue includes both those studies comparing information provided by different analyst sources and those comparing information provided from different job-knowledge bases (e.g., direct observation, no explicit information other than job title, etc.). Whereas there is evidence to support the claim that different analyst sources provide comparable information (e.g., Morsh, 1969; Smith & Bakel, 1979; and Cornelius & Lyness, 1980), there is also evidence that the analyst source does make a difference (e.g., Meyer, 1959; O'Reilly, 1973).

All of the studies which examined the means by which an analyst's information about the job was obtained indicated that this factor does not predict differences in resultant

job analysis information. Each of these studies, however, involved rather broad units of analysis, such as the PAQ or ratings on GATB dimensions, as opposed to requiring specific task-oriented information. It may be that the source of information and information base make little difference when jobs are analyzed by some methods but are important when other methods are used, such as task-oriented analyses. In terms of Schmidt's contention, a high amount of familiarity with the job may not be necessary for an analyst to determine the underlying abilities of that job. Although previous research has touched on this issue, a more detailed investigation seems necessary to examine the importance of analyst job familiarity in estimating ability requirements.

The purpose of this study was to examine whether job analysis agents make more accurate estimates of job ability requirements for relatively familiar jobs than for jobs with which they are less familiar. Also, accuracy of estimates are compared using two levels of job analysis units: in terms of job-specific abilities and general (GATB) abilities. Although a complete test of Schmidt's contention would involve examining the effect of job familiarity both in determining the relative importance of and in initially generating required abilities, the present research examining ability importance estimates provides important information bearing on the job familiarity issue.

HYPOTHESES

To investigate the effects of analyst familiarity with jobs and specificity level of the units in terms of which jobs are analyzed, the following hypotheses were tested in the present study:

1. Students unfamiliar with jobs should rate the importance of underlying abilities differently than people who are familiar with the jobs (job experts), regardless of the job or the units of analysis used to analyze them. This hypothesis is derived from discussions of job analysis which suggest that familiarity of the analyst with a job is essential for an accurate analysis.

2. Although non-expert analysts are expected to rate the importance of abilities differently than job experts, the degree of agreement between the two rating profiles should systematically vary depending on the job. That is, non-experts should make more accurate estimates of jobs with which they are relatively familiar, and progressively lower agreement with expert profiles should result as non-expert familiarity with the job decreases.

3. Similar to the second hypothesis, within one job, accuracy should decrease systematically as the reported level of non-expert job familiarity decreases.

4. In accordance with Cornelius et. al's (1979) results and Schmidt, Hunter and Pearlman's (1981) demonstration of aptitude test validity generalization, accuracy of non-expert rating profiles of specific job abilities should be significantly different from that obtained when jobs are analyzed in terms of general (GATB) abilities. Specifically, across jobs, accuracy should be higher for GATB abilities than for job-specific abilities.

5. There will be an interaction between job type and ability specificity, such that the increase in non-expert rating accuracy from lower- to higher-familiarity jobs will be significantly greater when specific job abilities are used than when general abilities are used.

6. Despite Schmidt, Hunter and Pearlman's (1981) evidence of validity generalization, the importance attributed to the familiarity which job analysts should have with the jobs they analyze led to the following hypothesis. When aptitude test scores on the GATB are weighted by both expert and non-expert GATB ability importance estimates, resultant totals for the two weighting procedures will be significantly different. Such a difference would indicate that the non-familiar student analysts would make different hiring decisions than would experts.

7. Analogous to the second hypothesis, the agreement between student- and expert-weighted GATB total scores should decrease across jobs as non-expert familiarity level with the jobs decreases.

PILOT STUDY

Subjects for the pilot study were 120 introductory psychology students. They completed a questionnaire indicating their degree of familiarity with each of the following jobs, provided with only job titles; secretary, firefighter, and power plant operator. Responses were made on a 9-point "degree of familiarity" scale. A copy of this questionnaire is included as Appendix A.

Results from the pilot study are summarized in Table 1. The study revealed that there is an implicit hierarchy of familiarity across the three jobs, with secretary the most familiar and power plant operator the least. T-tests on the differences between secretary and firefighter, and firefighter and power plant operator were both significant, $p < .05$. Ninety-five percent confidence intervals were constructed around each of the three means. For both comparisons, the upper bound of one job was sufficiently distant from the lower bound of the other job (firefighter-secretary, 5.6-6.0; power plant operator-firefighter, 3.5-5.1) to conclude that there were true student population familiarity differences across the jobs.

TABLE 1

Summary of T-Test Results for Familiarity Data

Job	Mean Rating	Standard Deviation	95% Confidence Interval	t
Power Plant Operator	3.2	1.7	2.9 - 3.5	$t(118) = 13.43^*$
Firefighter	5.4	1.3	5.1 - 5.6	$t(118) = 5.10^*$
Secretary	6.3	1.8	6.0 - 6.6	
*Significant at $p < .05$				

METHOD

SUBJECTS

Subjects were approximately 150 introductory psychology students, divided into three groups. Each of the three groups contained approximately equal numbers of males and females. Subjects received extra credit in an Introductory Psychology course for their participation.

MEASURES

Each student first read a job description, derived from those found in the Dictionary of Occupational Titles (DOT) (U.S. Department of Labor, 1977), for one of the three target jobs; and then estimated the relative importance of a number of abilities required by that job. The abilities listed for each job were sufficiently described or defined to insure that all students understood the nature of the abilities. Ability importance estimates were made on a five- or six-point scale, depending on the job. The scale used by students corresponded to that previously used by job experts to permit comparability across the two groups. Copies of the job descriptions and the abilities-estimates forms are provided as appendices B, C, D, and E. Appendices D and E are the secretary student-rating form and expert-rating form, respectively.

GAIB scores for 214 persons were obtained from the Virginia Employment Commission and were used in the second part of this study. Following are some of the characteristics associated with the sample of examinees: Sex--132 males, 82 females; Age--Median = 26 years, range = 18 to 53 years; Education--median = 12 years, range = 6 to 16 years; Ethnic Origin--120 caucasians, 55 blacks, 3 'other minority', and 36 'missing data'.

CRITERION SCORES

For the specific abilities, ratings made by job experts were used as criteria. For the secretary position, experts were sixteen clerk-typists, sampled from the U. S. Army Corps of Engineers (Charleston, SC), from Personnel Decisions Research Institute (Minneapolis, MN), and from Fieldcrest Mills, Inc. (Eden, NC). Reliability of their mean importance rating vector was .91. Firefighter job experts were chief level officers or department officials from 51 jurisdictions across the United States. These data were obtained in a job analysis of the entry level firefighter position performed by Bownas and Heckman (1976). Reliability of the mean importance rating profile was .97. Criterion ratings for power plant operators were reported by Bownas, Dunnette and Rosse (1980). Raters were 579

immediate supervisors of fossil fuel power plant operators. Reliability of the mean rating vector was .99.

Criterion importance scores for the nine GATB abilities came from several sources. For the firefighter position, expert data took the form of correlations between firefighters' GATB test scores and independently-rated job performance, obtained from the Virginia Employment Commission (VEC). Similar correlational norm data were obtained for the secretary position.

Since I collected the secretary expert data, ratings for both the specific and the GATB abilities were obtained. Reliability of this mean importance rating vector for the GATB abilities was .97. The two sets of criterion scores for secretary ability importance weights were compared by means of Kendall's tau correlation. This correlation was .389. In the planning stage, I expected that these ability importance profiles (expert-ratings and VEC norms) would be interchangeable, and planned to use the expert-generated ratings since they provided more information (such as rating variances and reliability estimates) than the VEC data. In light of the low correlation between the two profiles, however, both sets of criterion ratings were used and are reported separately.

Criterion importance weights for general abilities in the power plant operator position were taken from a PAQ job analysis, completed by 89 fossil fuel power plant operators. The PAQ computerized output routinely provides estimated minimum required standard scores for each of the nine GATB scales, based on a regression analysis of PAQ data from 179 representative U. S. jobs, and reported by Mecham and McCormick (1969).

PROCEDURE

Three groups of introductory psychology students were used, each rating one of the three jobs: secretary, n=39; firefighter, n=43; and power plant operator, n=39. Students were asked to indicate whether or not they had ever worked in the position which they were rating, and whether or not they had an immediate family member who had. Data for any subjects responding in the affirmative for either question were not used (with the exception of those analyses performed on only the secretary rating data). Subjects read a job description for the secretary, the firefighter, or the power plant operator position. Students then used a five- or six-point scale to rate the importance of the knowledges, skills and abilities (KSA's) required for each job, as well as the abilities tested by the General Aptitude Test Battery

(GATB). As noted earlier, each KSA and GATB ability was defined to insure that the raters understood the nature of these abilities.

ANALYSES

SPECIFIC ABILITIES

First, student ratings within each job were adjusted by subtracting the difference between the student and expert means from each student rating for each ability. This was done so that student ratings within each job had the same overall mean as expert ratings, thereby adjusting for possible level differences between student and expert ratings. Equation of the means in this study insured that multivariate analyses and correlational analyses would assess the same thing. That is, both strategies would solely involve assessment of profile pattern similarity since there would be no elevation differences.

Any conclusions derived from results of these analyses will be applicable to selection situations involving norm-referenced, rather than criterion-referenced testing and decision making (Allen & Yen, 1979). Specifically, given that an organization is interested in comparing applicants and selecting the most desirable on the basis of test performance, results from the present study will provide information concerning the influence of analyst job familiarity in determining test performance requirements.

Adjusted student weights for the specific job abilities were compared to the weights assigned by job experts for each position. This comparison involved computing a single-sample Hotelling's T-square for each job, comparing the vector of mean job ability ratings from students with the vector of ratings from experts. To perform this analysis for the specific power plant operator ratings, more than 39 subjects were required since 57 abilities were listed. Therefore, 24 more subjects were asked to analyze the power plant operator job using specific abilities, providing a total of 63 subjects for this one analysis. It was hypothesized that the T-square for each job would be significantly greater than zero, an indication that students and experts rated the importance of the abilities differently.

As noted, results of the pilot study confirmed that there are differences in the levels of general familiarity across the three jobs. If these familiarity differences are important for performing valid job analyses, we would expect to find differing levels of agreement between students' and experts' weightings of required job abilities across the three jobs. Calculation of Kendall's tau correlations between each student's rating vector and the mean expert rating vector provided an index of the accuracy with which

each individual analyzed the ability requirements of the job. A one-way ANOVA was performed using these tau correlations as data points. This tested whether familiarity across jobs affected the accuracy of the job analysis judgments. In the event of a significant effect for the job factor, simple comparisons would isolate the source (or sources) of these differences. It was hypothesized that correlations would be highest for the secretary job since familiarity was greatest for this position, lower for the firefighter job since moderate familiarity was indicated, and lowest for the power plant operator job since it was associated with the lowest degree of familiarity.

GENERAL (GATE) ABILITIES

To equate the means of student and expert GATB importance ratings, the expert data were adjusted so that they had the same overall mean and standard deviation (across nine abilities) as the student ratings. This adjustment was done so that the analyses would be tests for profile similarity and would not be influenced by possible elevation differences between profiles. Adjustment of the means was directly analogous to the mean adjustments performed on student ratings of specific abilities.

Equation of the standard errors was also required because the correlational criterion weights were on such a different scale than those for students. The only exception to this was the expert-generated ratings for the secretary job, in which case the student overall mean was equated to the expert mean.

The analyses described above for the specific abilities were performed again using student and criterion ability weighting vectors for the nine GATB abilities. These analyses were, similarly, tests of Hypotheses 1 and 2 for the general abilities.

ANALYSES OF FAMILIARITY DIFFERENCES WITHIN THE SECRETARY JOB

As discussed above, it was hypothesized that student-expert correlations would increase as student familiarity increased. However, an alternative explanation for any observed correlational differences might be advanced. Specifically, it could be argued that jobs which students and experts rate similarly are less factorially complex than those which the two groups rate differently. For example, if the secretary job were rated similarly by both students and experts, but the two groups rated the power plant operator job differently, one could suggest that the power plant operator job is more factorially complex (i.e., a more

complicated job), and that it was such a complexity difference which produced the less accurate ratings by non-experts.

To explore this hypothesis, an additional set of analyses was performed, using only the data for the secretary position. For this portion of the study, students were not excluded if they indicated a high degree of personal experience with the job of secretary. Student raters' familiarity scores for the secretary job were obtained and trichotomized, according to their responses on the Secretary "degree of familiarity" scale (see Appendix F): 1,2 and 3 = Level 1(unfamiliar); 4,5 and 6 = Level 2(moderate familiarity); and 7,8 and 9 = Level 3(high familiarity). Kendall's tau correlation of each student's rating vector with the mean expert vector was calculated. A priori contrasts were performed using the tau correlations as data points, to determine if there was a significant linear effect for familiarity level within the single job. To perform these trend analyses, analyses of variance were also required to obtain the error mean square. By performing these within-job analyses, the potential confound of differing levels of factorial complexity was controlled by holding the job constant. Support for the third hypothesis, therefore, required that students with

progressively higher degrees of familiarity with secretarial jobs exhibit increasing rating agreement with experts.

EFFECTS FOR ABILITY SPECIFICITY

The main effect for ability specificity (job specific vs. GATB) was tested by performing a one-way analysis of variance on the overall student-expert tau correlations (using data for all jobs), with ability level serving as an independent variable. It was hypothesized that there would be a significant effect for ability specificity level.

Concerning differences across jobs, an interaction between job type and ability specificity (specific vs. general) was hypothesized. It was expected that correlations for both levels of specificity would increase as the degree of general job familiarity increased, but the GATB correlations were expected to be higher at all points and to exhibit less of an increase across jobs than the specific ability correlations.

PREDICTED PERFORMANCE: STUDENT VS. EXPERT ABILITY WEIGHTS

An advantage of this phase of the study is that it is analogous to actual selection situations which involve ability testing. If differences between expert-weighted and student-weighted GATB scores are observed, and if

correlations between the two sets of scores increase with increased familiarity, it would indicate that a job analyst's familiarity with a job is an important factor in estimating required abilities. Thus, selection decisions based on the job analyst's evaluation of abilities required for successful performance on a given job would vary depending on his or her familiarity with the job.

To test this, test scores were obtained on the nine GATB abilities from the Virginia Employment Commission for 214 people. Individuals' scores on each ability were weighted or multiplied, first by the student GATB weights and then by the adjusted expert GATB weights. These products were summed across GATB dimensions to obtain a total predicted performance score for each subject in both the student-weighted and expert-weighted conditions. The Pearson Product-Moment correlation between these two sets of predicted performance scores was computed for each of the three jobs to test the similarity of selection decision outcomes using both student and expert weights.

In addition, a dependent-sample t-test was performed comparing mean predicted performance using student and expert ability weights. It was hypothesized that this difference would be significant, indicating that students and experts would make different hiring decisions. Also, as

in the first part of the study, it was expected that correlations between student- and expert-weighted scores would vary systematically across jobs. Specifically, correlations were expected to increase across jobs as the degree of job familiarity increased.

RESULTS

SPECIFIC ABILITIES

The first hypothesis, that students would rate the importance of abilities differently than experts regardless of job type was tested by calculating a one-sample Hotelling's T-square for each job. This was a test of whether the difference between the mean student rating profile and the expert rating profile for each job was significant. Results of these analyses are as follows: secretary, $T^2 = 168.48$ ($F(16,23) = 6.373, p < .001$); firefighter, $T^2 = 799.26$ ($F(20,23) = 21.88, p < .001$); power plant operator, $T^2 = 9586.7$ ($F(57,6) = 16.30, p < .001$). In each case, student ratings were significantly different from expert ratings.

Based on the results of the pilot study, the second hypothesis stated that job familiarity would have a significant effect on the accuracy of student ratings. Student rating accuracy was measured by Kendall's tau correlations between each student's rating vector and the appropriate mean expert vector. Results of the one-way ANOVA used to test this hypothesis are presented in Table 2. As indicated in Table 2, the job factor was significant ($F(2,118) = 16.183, p < .001$). Bonferroni simple paired

TABLE 2

Analysis of Variance Summary Table for Tau
Correlations between Student and Expert Ratings of
Specific Abilities

Source	df	SS	MS	F	F
Job	2	0.7131	0.3566	16.183	0.0000
S/Job	118	2.5998	0.0220		
Total	120	3.3129			

comparisons were performed to isolate the source or sources of this effect. These comparisons revealed that the secretary tau correlations were significantly higher than both the power plant operator correlations ($p < .01$) and the firefighter correlations ($p < .01$), but there was no difference between the firefighter and power plant operator taus.

To summarize, results for hypothesis tests of estimates involving specific abilities supported Hypothesis 1, and partially supported Hypothesis 2. For the former, significant Hotelling's T-squares for the student-expert comparisons within each job demonstrated that student ability importance estimates were significantly different from expert estimates. The latter hypothesis was tested by means of a one-way ANOVA, followed by simple paired comparisons. These comparisons indicated that students' accuracy of secretary ability ratings was significantly higher than their accuracy of firefighter and power plant operator ratings. However, there was no difference in the accuracy of student ratings for the firefighter versus the power plant operator abilities.

GENERAL (GATB) ABILITIES

Hypotheses 1 and 2 were tested for the GATB ability rating data using the same analyses as for the specific abilities. Results of the Hotelling's T-square analyses indicated that for each job, the mean student ability rating vector was significantly different from the expert rating vector: secretary (using correlational data from the VEC as the criterion rating vector), $T^2 = 469.72$ ($F(9,30) = 41.20$, $p < .001$); secretary (using expert-generated data as the criterion rating vector), $T^2 = 104.52$ ($F(9,30) = 9.17$, $p < .001$); firefighter, $T^2 = 1333.55$ ($F(9,34) = 119.95$, $p < .001$); power plant operator, $T^2 = 630.83$ ($F(9,30) = 55.34$, $p < .001$). Thus, student ratings for the general abilities were significantly different from expert ratings.

To test the second hypothesis for the GATB abilities, two one-way analyses of variance were performed. Both tested whether there was a main effect for job, and used as data points the tau correlations between each student's ratings and the criterion ability importance vector. The first ANOVA compared rating accuracy across the secretary (using VEC criterion data), firefighter and power plant operator jobs. The second ANOVA involved comparing accuracy across the secretary (using expert-generated criterion ratings), firefighter and power plant operator jobs. Tables 3 and 4 present summarized results of these analyses.

TABLE 3

Analysis of Variance Summary Table for Tau
Correlations between Student and Expert Ratings of
General (GATB) Abilities

Source	df	SS	MS	F	p
Job	2	3.8086	1.9043	31.762	0.0000
S/Job	118	7.0746	0.0600		
Total	120	10.8832			

NOTE: Using adjusted correlational data obtained
from the VEC as expert GATB ratings

TABLE 4

Analysis of Variance Summary Table for Tau
Correlations between Student and Expert Ratings of
General (GAIB) Abilities

Source	df	SS	MS	F	p
Job	2	17.0317	8.5158	160.659	0.0000
S/Job	118	6.2547	0.0530		
Total	120	23.2864			

NOTE: Using expert-generated data as the expert
GAIB data

Again, the job factor was significant (ANOVA 1: $F(2,118) = 31.762, p < .001$; ANOVA 2: $F(2,118) = 160.659, p < .001$). Bonferroni simple paired comparisons for both analyses of variance indicated that the difference between students' secretary and power plant operator accuracy measures (tau correlations) was significant ($p < .01$) as well as the difference between secretary and firefighter accuracy measures ($p < .01$). However, there was no significant difference between the accuracy of firefighter and power plant operator ratings.

In sum, results for hypothesis tests involving GATE abilities essentially duplicated those involving specific abilities. Hypotheses 1 and 2 were tested using the same analyses as those used with specific abilities. Hypothesis 1 was strongly supported, and Hypothesis 2 received partial support. The significant Hotelling's T-squares for each job indicated that students and experts rated differently, a result which was predicted by the first hypothesis. Analyses of variance followed by simple paired comparisons indicated that the accuracy of student estimates for the secretary job was higher than that for the firefighter and power plant operator jobs. Full support for the second hypothesis was not found, however, since there was no difference between the rating accuracy of the firefighter and the power plant operator jobs.

EFFECT FOR FAMILIARITY WITHIN THE SECRETARY JOB

Using only the data from the secretary job, one-way analyses of variance were performed. As noted earlier, familiarity level was trichotomized, and the tau correlations between each student's rating vector and the secretary expert vector served as data points. Three analyses of variance were performed: 1) based on tau correlations between student and expert ratings of specific job abilities; 2) based on tau correlations between student GATB ability importance ratings and the VEC correlational vector; and 3) based on tau correlations between student GATB ability importance ratings and expert-generated importance ratings. Results of these analyses are summarized in Tables G1, G2 and G3 of Appendix G, respectively.

Using the error mean squares from these analyses, a priori contrasts were performed for the two cases (corresponding to analyses 1 and 3 above) in which the data showed the predicted trend. These analyses were performed to determine whether students' familiarity level with the job of secretary affected the accuracy with which they estimated the importance of abilities. Results of the two a priori contrasts are as follows: specific ability taus, $F(1,45) = 0.003$ ($p > .05$); general ability taus (using

expert-generated ratings as the criterion vector), $F(1,45) = 5.237$ ($p < .05$). Thus, only in the case of students' accuracy in rating the importance of general job abilities, with true requirements assessed by expert ratings, did student familiarity with the secretary job have a significant linear effect.

Since the results for each ability level were different, analyses of variance were performed to test for an interaction between familiarity and ability level. Results of these analyses are summarized in Tables 5 and 6. Table 5 presents results for the analysis using VEC correlational data as the GATB criterion vector; Table 6 presents results for the analysis using expert-generated ratings as the GATB criterion vector. In neither case was the interaction significant ($p > .05$). For the analysis using expert-generated ratings as the criterion vector, however, this interaction approached significance ($p = .152$). Also, there was a significant main effect for ability level, in the ANOVA used to test the interaction. In this case, contrary to what will be discussed for the across-jobs analyses, the accuracy of GATB importance weights was higher for all familiarity levels than the accuracy of ratings in terms of specific abilities.

TABLE 5

Analysis of Variance Summary Table for Accuracy across
Familiarity and Ability Level for the Secretary Job

Source	df	SS	MS	F	p
Between-subjects					
Familiarity	2	0.01	0.01	0.11	0.8934
S/Familiarity	45	2.15	0.05		
Within-subjects					
Level	1	1.82	1.82	31.29	0.0001
Fam*Level	2	0.01	0.01	0.08	0.9267
Level*S/Fam	45	2.62	0.06		
Total	95	6.61			

NOTE: Using VEC data as the GATB criterion rating
vector

TABLE 6

Analysis of Variance Summary Table for Accuracy across
Familiarity and Ability Level for the Secretary Job

Source	df	SS	MS	F	P
Between-subjects					
Familiarity	2	0.14	0.07	1.23	0.3018
S/Familiarity	45	2.54	0.06		
Within-subjects					
Level	1	0.73	0.73	22.24	0.0001
Fam*Level	2	0.13	0.07	1.97	0.1515
Level*S/Fam	45	1.47	0.03		
Total	95	5.01			

NOTE: Using expert-generated ratings as the
GATB criterion rating vector

Due to the small number of student raters used in these within-job analyses (total $n = 48$), it was possible that there may have been insufficient power to detect true differences. Therefore, assuming that a tau difference of .10 across familiarity levels in the population would be the smallest effect of interest, a power analysis (Kirk, 1982) was performed. The population standard deviation of the taus was estimated using the standard deviations of taus within the sample. Results of this analysis indicated that the power of these within-job analyses was only approximately .25.

Although there was only one significant effect for familiarity, there was a general trend for the mean tau correlation to increase with increased familiarity. Table 7 provides the tau means and standard deviations for each familiarity group (level 1 = low; level 2 = moderate; level 3 = high) within each comparison.

In conclusion, results for the within-secretary job study partially supported Hypothesis 3. Linear trend analyses indicated only one significant trend. This was the case of rating accuracy compared across familiarity levels within ratings using GATB abilities (with expert-generated ratings used as the criterion vector). For this comparison, rating accuracy did significantly increase with increased

job familiarity of the raters. The interaction between ability specificity level and familiarity level approached significance, and a power analysis suggested that, with greater power, this interaction would have been significant.

EFFECTS FOR ABILITY SPECIFICITY

Analyses of variance were performed, using the tau correlations for all jobs and both ability specificity levels as dependent variables, and ability level and job as factors. Summary results for the two analyses (one using VEC expert data in computing the secretary GATB taus and one using expert-generated data for the secretary GATE taus) are presented in Tables 8 and 9 respectively. Hypothesis 4 stated that there should be a significant effect for ability level, with GATB taus being greater than job-specific ability taus. Although there was a significant effect for ability level ($p < .001$), it was not in the hypothesized direction. That is, student accuracy when the GATE abilities were the units of analysis was lower than when the specific abilities were used. Thus, the fourth hypothesis was not supported.

Hypothesis 5 stated that the job factor would interact with the level factor, such that the tau increase from the power plant operator to the firefighter to the secretary job

TABLE 7

Tau Means and Standard Deviations for Within-Secretary Study

Familiarity Level	N	Mean	Standard Deviation
Specific Abilities			
Low	17	0.3952	0.2149
Moderate	17	0.3976	0.2295
High	14	0.3991	0.1376
*General (GATB) Abilities			
Low	17	0.5015	0.2236
Moderate	17	0.5484	0.2543
High	14	0.6832	0.1622
**General (GATB) Abilities			
Low	17	0.1135	0.2399
Moderate	17	0.1041	0.3003
High	14	0.1524	0.2111

* Using expert-generated ratings as the criterion rating vector

**Using VEC data as the criterion rating vector

TABLE 8

Analysis of Variance Summary Table for Accuracy across
Job and Ability Level

Source	df	SS	MS	F	p
Between-subjects					
Job	2	3.68	1.84	46.97	0.0001
S/Job	114	4.47	0.04		
Within-subjects					
Level	1	8.59	8.59	190.75	0.0001
Job*Level	2	0.84	0.42	9.33	0.0002
Level*S/Job	114	5.13	0.05		
Total	233	22.71			

NOTE: Using VEC data as the GATB criterion rating
vector

TABLE 9

Analysis of Variance Summary Table for Accuracy across
Job and Ability Level

Source	df	SS	MS	F	p

Between-subjects					

Job	2	11.97	5.99	145.94	0.0001
S/Job	114	4.67	0.04		
Within-subjects					

Level	1	3.39	3.39	94.06	0.0001
Job*Level	2	5.66	2.83	78.53	0.0001
Level*S/Job	114	4.11	0.04		

Total	233	29.80			

NOTE: Using expert-generated importance ratings as
the GATB criterion rating vector

would be greater for the specific ability taus than for the GATB taus, with the GATB taus higher at all points. This hypothesis was not supported. Although there was a significant interaction between job and level ($p < .001$), the pattern of this interaction was quite different than that predicted. Specific ability taus were higher in general, and the larger increase across jobs resulted for the general ability taus. The patterns of these interactions are shown in Figures 1 and 2.

To summarize these results, the direction of the main effect for ability specificity was opposite to that predicted in Hypothesis 4. That is, analyses of variance used to test this effect across the three jobs were significant, with ratings using specific abilities being more accurate than those using general abilities. A significant interaction between job and ability specificity level resulted, although the pattern was different than that predicted in Hypothesis 5. It was predicted that GATB taus would be higher for all jobs, but the larger increase in accuracy across jobs would occur for the specific ability ratings. The observed interaction indicated that specific ability ratings were more accurate than GATB ratings, and the larger increase across jobs occurred for ratings based on the GATB abilities.

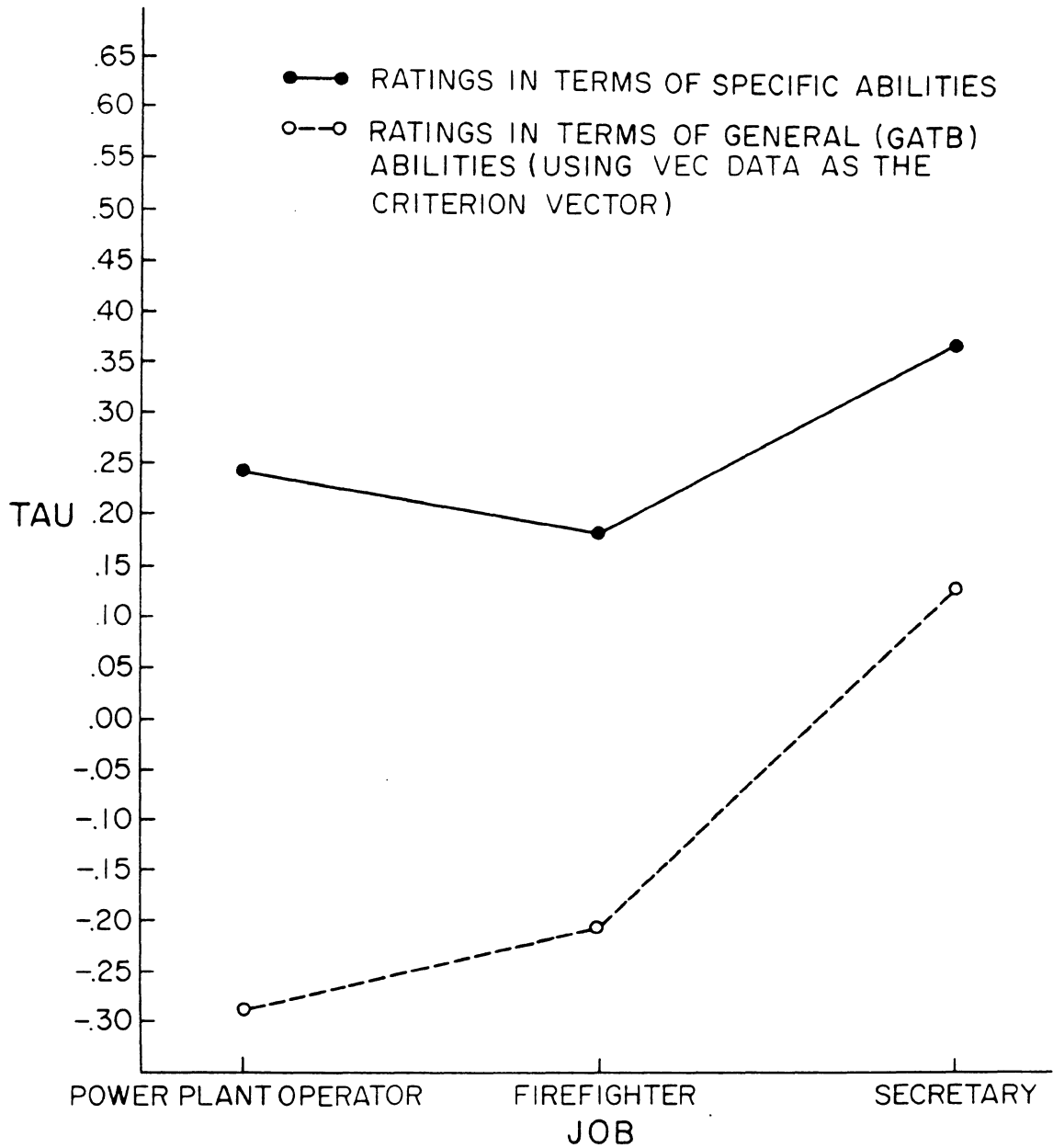


FIGURE 1. INTERACTION OF JOB WITH ABILITY LEVEL

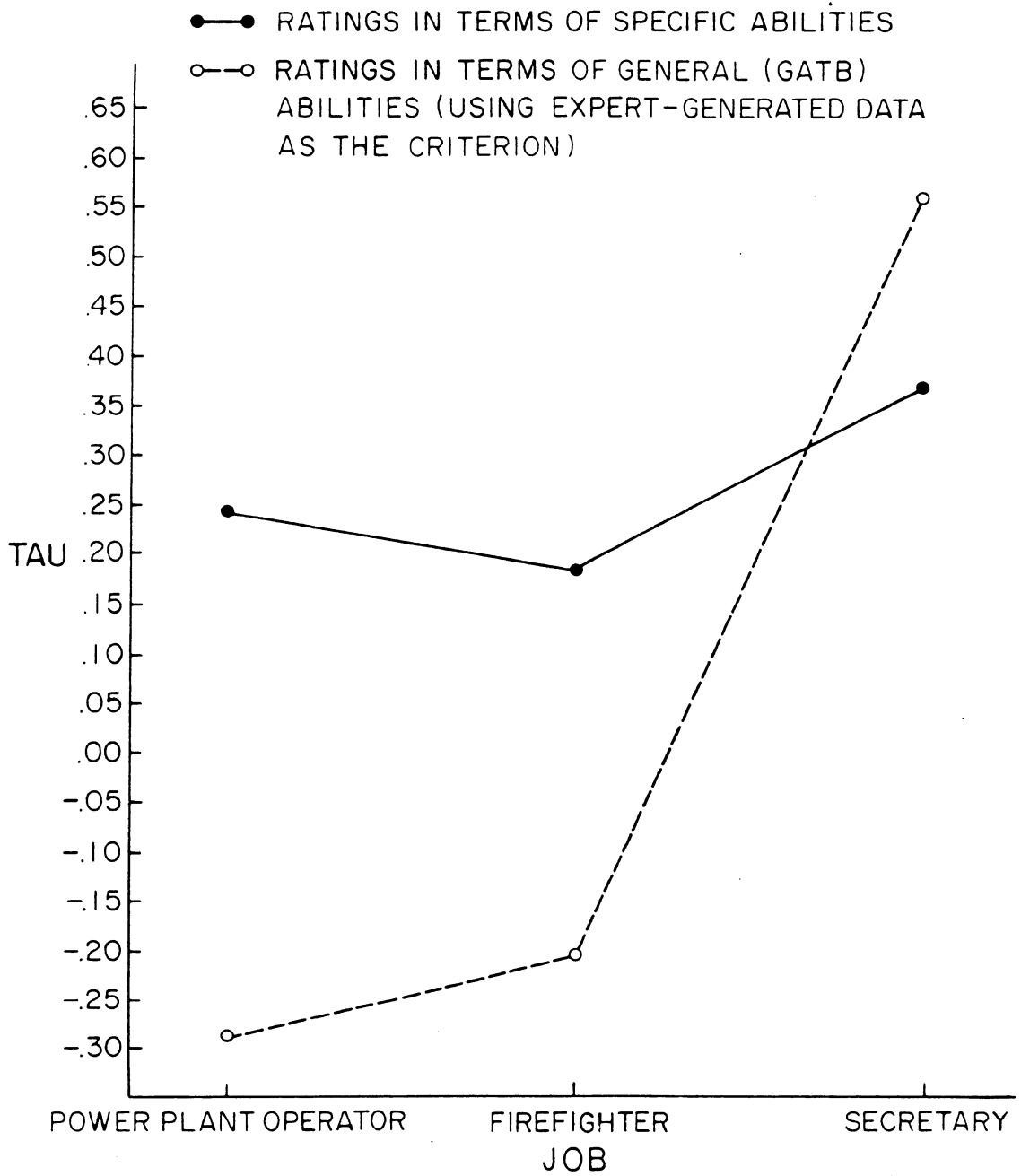


FIGURE 2. INTERACTION OF JOB WITH ABILITY LEVEL

COMPARISON OF PREDICTED PERFORMANCES

Hypothesis 6 predicted that total test scores on the GATB obtained by weighting scores on each ability by student importance weights would be different from totals obtained using expert importance weights. Four pairs of student-weighted and expert-weighted score vectors were correlated, with the following results: secretary (using VEC weights for the expert-weighted condition), $r = .982$ ($p < .001$); secretary (using expert-generated weights for the expert-weighted condition), $r = .999$ ($p < .001$); firefighter, $r = .976$ ($p < .001$); and power plant operator, $r = .984$ ($p < .001$). Following this test of similarity, a dependent-sample t-test was performed on each pair of score vectors to test for differences. Results were: secretary (using VEC weights for the expert-weighted condition), $t(113) = 2.13$ ($p < .05$); secretary (using expert-generated weights for the expert-weighted condition), $t(113) = 6.06$ ($p < .01$); firefighter, $t(113) = 0.84$ ($p > .05$); power plant operator, $t(113) = 3.80$ ($p < .01$). Thus, hypothesis 6 was partially supported. Table 10 presents summary results of both sets of analyses for each job.

The final hypothesis concerned the prediction that correlations would show significant increases across jobs as the associated familiarity levels increased. Hypothesis 7,

TABLE 10

Summary Results for Comparisons of Predicted Performance

N = 214

Expert	Student	Difference
--------	---------	------------

SECRETARY

Mean	2752.73	2762.14	-9.40
SD	342.57	400.60	64.49
r = .982***	t = -2.128*		

NOTE: Using VEC data as the criterion rating vector

SECRETARY

Mean	3695.75	3705.44	-9.68
SD	444.72	518.04	23.34
r = .999***	t = -6.056**		

NOTE: Using expert-generated ratings as the criterion rating vector

FIREFIGHTER

Mean	2296.39	2292.77	3.62
SD	289.69	243.09	63.14
r = .976***	t = 0.837		

POWER PLANT OPERATOR

Mean	3212.32	3230.46	-18.14
SD	396.79	517.90	69.65
r = .984***	t = -3.800**		

* p < .05

** p < .01

*** p < .001

however, could not be tested because it depended on the results for Hypothesis 6. The correlation differences between jobs were not in the predicted direction, precluding any further across-job comparisons.

In conclusion, results of correlational analyses of student and expert predicted performances suggested that the two patterns of weighted GATB test scores were quite similar for each job. Dependent-sample t-tests, however, indicated that there were significant mean differences in student- and expert-weighted test scores. Finally, Hypothesis 7 could not be evaluated since the differences in correlations between jobs did not follow the predicted trend.

DISCUSSION

The first hypothesis which was tested in this study predicted that student and expert ability importance ratings would be significantly different for all three jobs and for both levels of ability specificity. Significant Hotelling's T-squares in every case lended strong support for this hypothesis. In itself, this was not a terribly interesting finding. However, this demonstration of profile dissimilarity allowed further investigation of the degree to which other factors influence this relationship.

Type of job was the first factor studied. At this point, I was interested in determining whether, within ability specificity level, the accuracy with which students rated jobs depended on the type of job being rated. Results indicated that there was a main effect for job within each ability level. Since my hypothesis was based on the level of general familiarity associated with each job in the pilot study, I specifically predicted that student rating accuracy would increase across the power plant operator, firefighter and secretary jobs, respectively. Although paired comparisons revealed that for both ability levels secretary ratings were significantly more accurate than firefighter and power plant operator ratings, there was no significant

difference between the firefighter and power plant operator ratings. Thus, the second hypothesis was only partially supported. There are four possible explanations for this result.

First, there may have been no difference between the firefighter and power plant operator rating accuracies because subjects may have attended more directly to the job titles than to the job descriptions. Whereas job incumbents have full knowledge of what is involved in the day-to-day operations of a job from experience, non-expert raters may base their ratings largely on activities connotated by the job title. That is, for the firefighter job, non-expert raters may rate the importance of abilities only in terms of their importance to actual firefighting activities. The job title defines the primary work context as fire scenes, and the major job task as firefighting. Although this is the most important function of the firefighter job, emphasis on only one job situation may serve to reduce the ability of non-experts to base their ratings on the total scope of the job. For example, non-experts may rate the importance of abilities such as "Physical Strength" (ability number 1) and "Courage" (ability number 10) as most important, and yet fail to realize the importance of "Getting along with people" (ability number 16) and "Honesty" (ability number

17). For the power plant operator job, however, the title itself more accurately defines the work context as well as the primary job functions. Thus, according to this explanation, accuracy of non-expert firefighter ratings was lower than expected because of the restrictive definitional nature of the firefighter job title as compared to the title "power plant operator". However, the influence of this factor should have been minimized by the similar coverage of the two jobs contained in the job descriptions.

A second possibility is that, despite similar coverage provided by the job descriptions, inclusion of 57 specific abilities for the power plant operator job (compared to only 20 for the firefighter job) may have served to better describe the nature of the job. This explanation assumes that providing numerous specific cues when actual familiarity is low may increase raters' job knowledge, upon which the analysis is based. In this study, raters were told that the abilities listed "might be required for successful performance of the job." Presumably, from the rater's perspective, each ability was included because it was of at least some importance to the job. Since for the specific abilities this was indeed the case, the larger number of power plant operator abilities may have resulted in increased cues about job content for the power plant operator raters.

Third, because levels of familiarity varied across jobs, selective attention to the provided list of abilities, both general and specific, may have occurred. That is, when rating jobs with which they felt familiar (such as the secretary job), raters may have based judgments on their prior knowledge about the job. On the other hand, when rating totally unfamiliar jobs, raters had little prior job knowledge, and may have been more influenced by the cues actually provided (in this case, the job description and list of abilities). In this study, the secretary raters may have been basing their ratings on prior job knowledge, whereas power plant operator raters may have based their ratings on the cues provided about the job. The firefighter raters may have based their judgments on some combination of prior knowledge and provided cues. Therefore, the degree to which prior job familiarity increased rating accuracy may have depended on the degree to which reported familiarity reflected actual job knowledge. According to this explanation, secretary raters' reported job familiarity must have reflected more actual job knowledge than that underlying reports of familiarity for the firefighter job. This variation in actual job knowledge is considered in discussion of the final possibility.

Although the above possibility has been discussed in terms of student raters, it can easily be extended to actual job analysis situations. If, as Schmidt (1979) recommends, an analyst need only observe performance on a job for a short period of time, the analyst's prior familiarity with the job may affect how s/he directs his/her attention during this observational period. Less familiar job analysts may attend more closely to worker behavior, and may spend less time confirming pre-existing beliefs about job content than do analysts who are more familiar with the job being analyzed. This is not to say that unfamiliar analysts will provide more accurate job analysis information. It does suggest, however, that provision of more cues about a job by means of a greater number of relevant abilities or an extended, more inclusive observational period, may compensate for low prior familiarity.

The final possibility involves an evaluation of the information sources upon which individuals base perceptions of their job familiarity. It may be that exposure to the secretary job primarily takes the form of personal contact, such as business or educational/administrative transactions, supplemented with some media exposure. Opportunities for personal exposure to the firefighter job, on the other hand, are much less frequent. Thus, most exposure to the

firefighter job is probably media-based. Further, media-based portrayals of the firefighter job focus on the actual firefighting situation much more strongly than other job facets. The result may be a high level of reported familiarity, with a substantially lower level of actual job knowledge. Raters may base their ability importance judgments on these stereotypic perceptions of what a firefighter job entails. Finally, opportunities for exposure to the power plant operator job, either personal or media-based, are relatively infrequent. Therefore, the lack of prior stereotypes for this job may result in increased reliance on job description and ability list cues provided in the analysis situation, and ultimately, more accurate ratings.

A main effect for ability specificity was found, although it was not in the expected direction. I predicted that the student mean accuracy level would be higher when jobs were analyzed in terms of general abilities than in terms of specific abilities. The higher overall accuracy which was, in fact, obtained for ratings of specific abilities may also be interpreted according to the above argument that less translation of specific job knowledges into underlying abilities is required for specific ability importance ratings. In effect, ratings for the specific

abilities may require less cognitive processing than is required for the general ability ratings, thus minimizing errors resulting from inaccurate translation of raters' job knowledge into ability importance judgments.

Another possibility relates to the discussion above suggesting that provision of abilities which are greater in number and more specific may serve to increase raters' job knowledge. This increased knowledge of the job might then provide a more accurate information base from which to rate the job. One experimental test of this would involve a comparison of the accuracy with which raters judge the importance of general abilities after already having rated specific abilities, to the accuracy level of GATB ratings without prior experience with the specific abilities. My study involved no such manipulation since the anticipated effect for ability specificity was in the opposite direction. Order of specific-ability and GATB-ability presentation was balanced in the present study, but the order of presentation was not recorded for individual subjects, and therefore could not be analyzed.

In terms of the predicted interaction between ability level and job type, results did indicate a significant interaction; however, the pattern of the observed interaction was different than that predicted. Based on my

hypothesis that general ability ratings would be more accurate than specific ability ratings, I predicted that accuracy for the GATB ratings would be higher for all jobs, but that the improvement in accuracy with increased familiarity would be larger for the specific abilities than the general abilities. Results supported the exact opposite: accuracy of specific ability ratings was generally higher, and the greater increase in accuracy with increased familiarity occurred for the general abilities. In light of the discussion thus far, this effect might be interpreted as indicating that experience with specific abilities provides further familiarity with the job, suppressing the beneficial influence of prior job familiarity.

The within-secretary job study was conducted in hopes of providing additional evidence for the effect of familiarity on accuracy of ratings. Although there was a general trend for raters with high familiarity to provide more accurate judgments, this trend was significant only for the GATB ability estimates. The interaction between familiarity and ability specificity approached significance. A power analysis indicated power of approximately .25, which definitely limited the ability of the contrasts and interaction tests to detect differences. Even after this is

taken into account, however, it is unlikely that the accuracy of either student GATB ability ratings when VEC data were used as the criterion vector or the specific ability ratings would show a significant trend. The interaction between ability level and job familiarity, however, probably would have been significant if the test had been more powerful.

As noted earlier, the main effect for ability level in the above comparison indicated that general abilities were rated more accurately than specific abilities. This within-job finding is opposite to the direction of the ability level main effect for the across-job analyses.

The presence of an effect for the GATB ratings but not for the specific ratings, as well as the nonsignificant ability level by familiarity interaction, are analogous to the across-job interaction discussed above. That is, differences in familiarity were associated with differences in accuracy for only ratings using general abilities. One possible interpretation of this effect therefore concerns the increase in job knowledge provided by experience with specific ability ratings, which minimizes the effect which prior familiarity can exert.

In addition, the reversal of the main effect for ability level in the within-secretary study as compared to

the across-job study supports the argument that the reported levels of familiarity for secretary raters did reflect actual job knowledge. Raters may then have relied more on this actual job knowledge than on the cues provided about job content. In this case, the original hypothesis, that analyst accuracy when general abilities are the units of analysis would be enhanced, had the opportunity to operate. It is unclear, however, as to why the accuracy of general ability ratings would not have been higher than that for specific ability ratings in all cases where the secretary job was analyzed.

Finally, the within-secretary job study was conducted largely in an attempt to show that differences in job complexity could not be the sole explanation for any observed differences in student rating accuracy. In light of the results, the factor of job complexity cannot be dismissed as unimportant. There is, however, an effect for job familiarity which operates independently of job complexity to increase analysis accuracy when general abilities are the units of analysis.

The final set of analyses were those comparing predicted performance using expert and student GATB ability importance weights. It was predicted that expert-weighted test scores would be different from student-weighted test

scores. This hypothesis was tested in two ways. First, the correlations between the expert- and student-weighted totals indicated that for each job, the score vectors were highly similar. In accordance with conclusions from Burt's (1980, 1983) research, this indicates that the pattern of weighted test scores for the 214 examinees was nearly identical using student and expert weighting schemes. Thus, norm-referenced decision-making for purposes of selection would result in the same selection decisions, regardless of whether GATE ability importances were based on the judgments of students or experts.

The three significant differences found using the dependent-sample t-tests, however, suggest that the source of job analysis information may make a difference if criterion-referenced selection decisions with arbitrary cutting scores are made. The significant t values indicated that mean predicted performance would be different depending on whether students or experts were judging the relative importance of underlying abilities. For example, using strictly arbitrary cutoff scores as the basis for hiring decisions may result in different decisions by the two types of analysts. It may be of interest to note that for each significant comparison, the student-weighted test scores were higher than the expert-weighted scores. This suggests

that if criterion-referenced decisions were made, those based on job analysis information provided by students would result in selection of a higher percentage of applicants.

It is interesting that Hotelling's T-square analyses indicated that student and expert ratings were significantly different for all comparisons, and yet ultimate norm-referenced selection decisions based on these sources of information would be identical. To explore this apparent inconsistency, the intercorrelation matrix of the observed GATB test scores was examined. The median correlation between abilities was .38 ($p = .000$), with a range of .08 to .84. In light of the fact that the GATB ability test scores are so highly intercorrelated, it is not surprising that the weighted total test scores were so similar. The GATB provides tests of six cognitive abilities and three motor abilities. The median correlation among cognitive abilities was .57. Thus, it was the addition of three motor abilities which lowered the median correlation to .38. This suggests that when general cognitive abilities are tested for purposes of norm-referenced selection, differentially weighting the importance of these abilities makes little practical difference. An important implication of this is that familiarity of a job analyst with the job in question will have little influence on selection decisions based on the analysis information.

REFERENCES

- Allen, M. J., & Yen, W. M. (1979). Introduction to Measurement Theory. Monterey, CA: Brooks/Cole.
- Bass, B. M., & Barrett, G. V. (1981). People, work, and organizations (2nd ed.). Boston: Allyn and Bacon.
- Bownas, D. A., & Heckman, R. W. (1976). Job analysis of the entry level firefighter position. Personnel Decisions Research Institute: 2415 Foshay Tower, Minneapolis, MN 55402 (NTIS No. PB-271 534/AS).
- Bownas, D. A., Dunnette, M. D., & Bosse, R. L. (July 1980). Electric power plant study: analysis of job activities and personal qualifications of operators in electric power generating plants (PDRI Tech. Rep. 46). 2415 Foshay Tower, Minneapolis, MN 55402: Personnel Decisions Research Institute.
- Burt, R. E. (1980). The equivalence of job analysis agents: A methodological reappraisal. Unpublished doctoral dissertation. The University of Tennessee at Knoxville, 1980.
- Burt, R. E. (1983). The dissimilarity of job analysis ratings from supervisors and incumbents. Paper presented at the American Psychological Association Convention, Anaheim, CA.
- Cascio, W. F. (1982). Applied psychology in personnel management (2nd ed.). Reston, VA: Reston Publishing.
- Cornelius, E. T., Carron, T. J., & Collins, M. N. (1979). Job analysis models and job classification. Personnel Psychology, 32, 693-708.
- Cornelius, E. T., & Lyness, K. S. (1980). A comparison of holistic and decomposed judgment strategies in job analyses by job incumbents. Journal of Applied Psychology, 65, 155-163.
- Hazel, J. T., Madden, J. M., & Christal, R. E. (1964). Agreement between worker-supervisor descriptions of the worker's job. Journal of Industrial Psychology, 2, 71-79.

- Jones, A. P., Main, D. S., Butler, M. C., & Johnson, L. A. (1982). Narrative job descriptions as potential sources of job analysis ratings. Personnel Psychology, 35, 813-828.
- Kirk, R. E. (1982). Experimental design: procedures for the behavioral sciences (2nd ed.). Belmont, CA: Brooks/Cole.
- Levine, E. L., Ash, R. A., & Bennett, N. (1980). Exploratory comparative study of four job analysis methods. Journal of Applied Psychology, 65, 524-535.
- McCormick, E. J. (1979). Job analysis: methods and applications. New York: AMACOM.
- McCormick, E. J., Jeanneret, P. R., & Mecham, R. C. (1972). A study of job characteristics and job dimensions as based on the position analysis questionnaire (PAQ). Journal of Applied Psychology, 56, 347-368.
- Mecham, R. C., & McCormick, E. J. (June 1969). The use of data based on the position analysis questionnaire in developing synthetically-derived attribute requirements of jobs. (Off. Naval Res. Rep. 4). Purdue University, Lafayette, IN: Occupational Research Center.
- Meyer, H. H. (1959). Comparison of foreman and general foreman conceptions of the foreman's job responsibility. Personnel Psychology, 12, 445-452.
- Morsh, J. E. (1964). Job analysis in the United States Air Force. Personnel Psychology, 17, 7-17.
- O'Reilly, A. P. (1973). Skill requirements: supervisor-subordinate conflict. Personnel Psychology, 26, 75-80.
- Prien, E. P., & Ronan, W. W. (1971). Job analysis: a review of research findings. Personnel Psychology, 24, 371-396.
- Schmidt, F. L. (October 1979). Presentation at the University of Minnesota Industrial/Organizational Proseminar, Minneapolis, MN.
- Schmidt, F. L., & Hunter, J. E. (1977). Development of a general solution to the problem of validity generalization. Journal of Applied Psychology, 62, 529-540.

- Schmidt, F. L., Hunter, J. E., Pearlman, K., & Shane, G. S. (1979). Further tests of the Schmidt-Hunter Bayesian validity generalization procedure. Personnel Psychology, 32, 257-281.
- Schmidt, F. L., Hunter, J. E., & Pearlman, K. (1981). Task differences as moderators of aptitude test validity in selection: a red herring. Journal of Applied Psychology, 66, 166-185.
- Smith, J. E., & Hakel, M. D. (1979). Convergence among data sources, response bias, and reliability and validity of a structured job analysis questionnaire. Personnel Psychology, 32, 677-692.
- Trattner, M. H., Fine, S. A., & Kubis, J. F. (1955). A comparison of worker requirement ratings made by reading job descriptions and by direct job observation. Personnel Psychology, 8, 183-194.
- U. S. Department of Labor, Employment & Training Administration. (1977). Dictionary of Occupational Titles (4th ed.). Washington, DC: U. S. Government Printing Office.
- U. S. Department of Labor, Handbook for analyzing jobs. (1972). Washington, DC: U. S. Government Printing Office.

Appendix A

PILOT STUDY FAMILIARITY QUESTIONNAIRE

This questionnaire will provide important information needed to conduct a later study. It is necessary that the amount of familiarity which people have with the three jobs mentioned below be determined. Please indicate the degree of familiarity which you feel you have with each of the following jobs, and the abilities that are required to perform them. Do this by circling the appropriate number for each job.

FIREFIGHTER		POWER PLANT OPERATOR		SECRETARY	
1	Know nothing about this job.	1	Know nothing about this job.	1	Know nothing about this job.
2		2		2	
3	Know very little about this job.	3	Know very little about this job.	3	Know very little about this job.
4		4		4	
5	Know a moderate amount about this job, largely through TV shows and other such sources.	5	Know a moderate amount about this job, largely through TV shows and other such sources.	5	Know a moderate amount about this job, largely through TV shows and other such sources.
6		6		6	
7	Know a good deal about this job. Have known people who have worked this job.	7	Know a good deal about this job. Have known people who have worked this job.	7	Know a good deal about this job. Have known people who have worked this job.
8		8		8	
9	Know a great deal about this job. Have previously worked it myself.	9	Know a great deal about this job. Have previously worked it myself.	9	Know a great deal about this job. Have previously worked it myself.

Appendix B

FIREFIGHTER ABILITY RATING FORM

This study is being done to determine whether people who are relatively unfamiliar with certain jobs (like you) can give accurate information concerning the skills and abilities needed in these jobs. The attached handout begins with a brief description of a position, including the major duties defining the job. Following this description are lists of abilities, one list of abilities specific to this job and one list of more general abilities, which might be required for successful performance of the job. After you have read the job description, rate the importance of each ability for performing the job, using the rating scale printed below. Fill in the proper circle of the appropriate opscan for each numbered ability.

- 1 -- Very low importance
- 2 -- Low importance
- 3 -- Medium importance
- 4 -- High importance
- 5 -- Very high importance

Please check the appropriate blanks in the following two items:

I _____ have, _____ have not ever held the position of firefighter.

I _____ do, _____ do not have an immediate family member who has ever held the position of firefighter.

Controls and extinguishes fires, protects life and property, and maintains equipment as volunteer or employee of city, township, or industrial plant. Responds to fire alarms and other emergency calls. Selects hose nozzle, depending on type of fire, and directs stream of water or chemicals onto fire. Positions and climbs ladders to gain access to upper levels of buildings or to assist individuals from burning structures. Creates openings in buildings for ventilation or entrance, using ax, chisel, crowbar, electric saw, core cutter, and other power equipment. Protects property from water and smoke by use of waterproof salvage covers, smoke ejectors, and deodorants. Administers first aid and artificial respiration to injured persons and those overcome by fire and smoke. Communicates with superior during fire, using portable two-way radio. Inspects buildings for fire hazards and compliance with fire prevention ordinances. Performs assigned duties in maintaining apparatus, quarters, buildings, equipment, grounds, and hydrants. Participates in drills, demonstrations, and courses in hydraulics, pump operation and maintenance, and firefighting techniques. May fill fire extinguishers in institutions or industrial plants. May issue forms to building owners listing fire regulation violations to be corrected. May drive and operate firefighting vehicles and equipment.

SPECIFIC ABILITIES

1. **PHYSICAL STRENGTH:** ability to make and sustain strenuous exertions; ability to lift, carry, or control heavy weights; ability to maintain physical exertion over a long period of time
2. **GENERAL BODY COORDINATION:** ability to maintain balance while moving; ability to coordinate the movement of one's limbs with visual inputs; ability to move one's arms and legs quickly
3. **QUICKNESS:** ability to respond quickly to external events; reaction time; ability to perform a complicated series of movements quickly in the proper sequence
4. **DEXTERITY:** ability to make precise, accurate movements of one's hands and arms, and to manipulate small objects with one's hands and fingers
5. **VISUAL ACUITY:** ability to distinguish small details from a complex background; accurate depth perception; ability to imagine what an object would look like if seen from a different perspective
6. **VERBAL SKILLS:** ability to read, write, understand spoken messages, and speak fluently
7. **MATH SKILLS:** ability to perform arithmetic computations
8. **PROBLEM SOLVING ABILITY:** ability to perceive small details and size up situations quickly and accurately; sensitivity to cues which indicate problems; ability to focus on a task and ignore distractions; preparing for potential problems before they arise, creativity in solving problems
9. **MECHANICAL ABILITY:** ability to understand mechanical systems and how they work
10. **COURAGE:** willingness to work in dangerous situations; ability to work in high or closely confining areas; willingness to continue working despite physical discomfort
11. **RESISTANCE TO STRESS:** ability to perform coolly and efficiently during crisis and emergency situations and under extremely tight time pressure

12. TEAMWORK: ability to work with others as part of a team; anticipating what others will do, and cooperating with them

13. ACTIVITY: being energetic; working quickly and efficiently; being active, enthusiastic, and lively; aggressiveness (but not hostility)

14. RESPONSIBILITY: being conscientious, responsible, and dependable; willingness to seek and accept responsibility

15. DESIRE TO LEARN: desire to pick up new information; desire to improve current skills and acquire new ones; taking personal pride in one's abilities, and wanting to improve them

16. GETTING ALONG WITH PEOPLE: liking to be with other people; having a sense of humor; ability to accept hazing, ribbing, practical jokes, etc.; being outgoing and friendly; ability to understand the motives and behavior of others; ability to deal openly and comfortably with strangers

17. HONESTY: being honest and trustworthy

18. CLEANLINESS: keeping one's self and one's living quarters clean and neat

19. MEDICAL INTEREST: interest in medical services and activities; interest in human anatomy and biology

20. CONSTRUCTION TRADE INTEREST: interest in building construction techniques, carpentry, and building trades

GENERAL ABILITIES

1. **INTELLIGENCE:** General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgments. Closely related to doing well in school.
2. **VERBAL APTITUDE:** The ability to understand meaning of words and to use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.
3. **NUMERICAL APTITUDE:** The ability to perform arithmetic operations quickly and accurately.
4. **SPATIAL APTITUDE:** Ability to think visually of geometric forms and to comprehend two-dimensional representation of three-dimensional objects. The ability to recognize the relationships resulting from the movements of objects in space.
5. **FORM PERCEPTION:** Ability to perceive pertinent detail in objects or in pictorial or graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.
6. **CLERICAL PERCEPTION:** Ability to perceive pertinent detail in verbal or tabular material. Ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation. A measure of speed of perception is required in many industrial jobs even when the job does not have verbal or numerical content.
7. **MOTOR COORDINATION:** Ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make movement response accurately and swiftly.
8. **FINGER DEXTERITY:** Ability to move fingers, and manipulate small objects with fingers, rapidly or accurately.
9. **MANUAL DEXTERITY:** Ability to move hands easily and skillfully. To work with hands in placing and turning motions.

Appendix C

POWER PLANT OPERATOR ABILITY RATING FORM

This study is being done to determine whether people who are relatively unfamiliar with certain jobs (like you) can give accurate information concerning the skills and abilities needed in these jobs. The attached handout begins with a brief description of a position, including the major duties defining the job. Following this description are lists of abilities, one list of abilities specific to this job and one list of more general abilities, which might be required for successful performance of the job. After you have read the job description, rate the importance of each ability for performing the job, using the rating scale printed below. Fill in the proper circle of the appropriate opscan for each numbered ability.

- 1 -- Not important at all
- 2 -- Much less important than other abilities
- 3 -- Less important than other abilities
- 4 -- About the same as most other abilities
- 5 -- More important than other abilities
- 6 -- Much more important than other abilities

Please check the appropriate blanks in the following two items:

I -----have, -----have not ever held the position of power plant operator.

I -----do, -----do not have an immediate family member who has ever held the position of power plant operator.

Operates boilers, turbines, generators, and auxiliary equipment at generating plants to produce electricity. Monitors control board and regulates equipment following recording and indication instruments. Adjusts controls of water and cold feed systems, blowers, and igniters to start up or shut down boilers. Controls operation of boiler auxiliary equipment, such as water and vacuum pumps, coal driers and pulverizers, steam condensers, and soot blowers to insure efficient operation of boilers. Starts turbines and boiler auxiliary units. Adjusts throttle and vacuum-breaker valve to engage governor that regulates speed of turbines. Adjusts boiler controls to provide steam at specified temperature and pressure for turbine loads according to power demands. Adjusts controls to regulate speed, voltage, and phase of incoming turbines to coincide with voltage and phase of power being generated. Synchronizes incoming generating units with units in operation and closes circuit breaker at exact instant of coincidence. Monitors gages to determine effect of generator load on related equipment, such as bus bars and voltage regulators. Adjusts transformer controls to regulate flow of power between generating stations and substations. Monitors panelboard to control operations of turbines to detect equipment malfunctions. Stops turbines

when malfunctions occur, following operating instructions. Operates switchgear to regulate and transfer power loads to protect maintenance workers engaged in repairing or cleaning equipment. Records instrument readings at specified intervals, and records malfunctions of equipment, instruments, or controls on logsheet.

SPECIFIC ABILITIES

1. Willingness to work rotating shifts or overtime, any day of week, including holidays

Willingness and ability to work:

2. in high places
3. around high voltage
4. around high-pressure fluids
5. around rotating/revolving equipment/machinery
6. around flammable chemicals and substances
7. around hazardous chemicals
8. in extreme temperatures
9. in noisy places
10. in dirty places
11. around fire
12. Mechanical ability; ability to understand basic mechanical principles (e.g., gear trains, centrifugal force, heat flow)
13. Reading comprehension ability at 8th grade level
14. Reading comprehension ability at 12th grade level
15. Manual dexterity; ability to manipulate controls, tools, or parts with hands and fingers
16. Desire to progress to higher levels of operation
17. Investigative interests: inquisitive; curious; interested in learning how things work; willing to dig for information to solve a problem; willing to ask questions
18. Color Vision: ability to distinguish red, yellow, blue, and green colors
19. Normal peripheral visual field (150° -180°)

20. Visual acuity: ability to distinguish small details from a complex background; ability to read indicator numbers from a normal viewing distance
21. Depth perception
22. Auditory acuity: ability to hear changes in pitch or loudness of equipment noises; ability to distinguish spoken language from a noisy background
23. Tactual acuity: ability to feel heat or vibrations in equipment
24. Sense of smell
25. Ability to read and comprehend blueprints, schematics, diagrams, scatter plots; ability to relate abstract drawings to actual equipment or structures
26. Ability to respond appropriately under stress
27. Emotional stability: freedom from psychopathology and abnormal or aberrant behavior
28. Analytical ability: ability to reason way through problems; detect trends; plan actions in a logical, orderly manner
29. System comprehension: ability to comprehend entire systems and how they function; ability to foresee system implications of malfunctions or of own actions; ability to anticipate required future conditions in numerous interacting systems
30. Ability to retain and recall information
31. Attention to detail: ability to perceive and interpret small details
32. Conscientiousness in checking and caring for equipment
33. Ability to add, subtract, multiply and divide whole numbers, decimals, fractions
34. Ability to comprehend, use, and/or compute logs, powers, trigonometry, scientific notation
35. Ability to follow complex sequence of activities

36. Ability to communicate oral information clearly and accurately in English
37. Ability to read and understand gauges, meters, indicators
38. Ability/willingness to follow set routines/procedures
39. Ability to work closely with other people
40. Ability to work alone in geographically remote, isolated setting for one or more shifts
41. Willingness to remain with company; career orientation
42. Ability to remain vigilant and efficient over long, uneventful shift periods
43. Ability to transfer learning to a new setting
44. Ability to accept and deal with change in procedures, work crew make-up, and equipment
45. Assertiveness in following up on requests/instructions to auxiliary operators, maintenance personnel, etc.
46. Willingness/ability to remain relatively inactive in control room or similar area for entire shift
47. Willingness to appear for work on assigned shift regularly and on time
48. Physical ability to climb stairs and ladders, operate stiff valves manually, lift weights, control pneumatic or hydraulic wrenches
49. Willingness to accept instructions or seek help or guidance
50. Willingness to work under both close and remote supervision
51. Willingness/ability to instruct others
52. Ability to stand for long periods
53. Ability to estimate sizes, dimensions, and/or volumes accurately

54. Willingness to comply with routine safety precautions (e.g., wear safety goggles, hearing protectors, hard hats)

55. Ability to write legibly

56. Ability to compose understandable written communications

57. Ability to selectively screen large amounts of information from numerous sources, and identify items requiring specific attention

GENERAL ABILITIES

1. INTELLIGENCE: General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgments. Closely related to doing well in school.
2. VERBAL APTITUDE: The ability to understand meaning of words and to use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.
3. NUMERICAL APTITUDE: The ability to perform arithmetic operations quickly and accurately.
4. SPATIAL APTITUDE: Ability to think visually of geometric forms and to comprehend two-dimensional representation of three-dimensional objects. The ability to recognize the relationships resulting from the movements of objects in space.
5. FORM PERCEPTION: Ability to perceive pertinent detail in objects or in pictorial or graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.
6. CLERICAL PERCEPTION: Ability to perceive pertinent detail in verbal or tabular material. Ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation. A measure of speed of perception is required in many industrial jobs even when the job does not have verbal or numerical content.
7. MOTOR COORDINATION: Ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make movement response accurately and swiftly.
8. FINGER DEXTERITY: Ability to move fingers, and manipulate small objects with fingers, rapidly or accurately.
9. MANUAL DEXTERITY: Ability to move hands easily and skillfully. To work with hands in placing and turning motions.

Appendix D

SECRETARY STUDENT ABILITY RATING FORM

This study is being done to determine whether people who are relatively unfamiliar with certain jobs (like you) can give accurate information concerning the skills and abilities needed in these jobs. The attached handout begins with a brief description of a position, including the major duties defining the job. Following this description are lists of abilities, one list of abilities specific to this job and one list of more general abilities, which might be required for successful performance of the job. After you have read the job description, rate the importance of each ability for performing the job, using the rating scale printed below. Fill in the proper circle of the appropriate opscan for each numbered ability.

- 1 -- Not important at all
- 2 -- Much less important than other abilities
- 3 -- Less important than other abilities
- 4 -- About the same as most other abilities
- 5 -- More important than other abilities
- 6 -- Much more important than other abilities

Please check the appropriate blanks in the following two items:

I ____ have, ____ have not ever held the position of secretary.

I ____ do, ____ do not have an immediate family member who has ever held the position of secretary.

Schedules appointments, gives information to callers, takes dictation and otherwise relieves officials of clerical work and minor administrative and business detail. Reads and routes incoming mail. Locates and attaches appropriate file to correspondence to be answered by employer. May take dictation in shorthand or by machine and transcribe notes on typewriter or transcribe from voice recordings. Composes and types routine correspondence. May compute and verify totals on report forms, requisitions, or bills. Files correspondence and other records according to relevant filing system. May locate and remove material from files when requested. May handle confidential information. May enter data on records and dispose of obsolete files. Answers telephone, gives information to callers or routes call to appropriate official, and places outgoing calls. Schedules appointments for employer. Greets visitors, ascertains nature of their business, and conducts visitors to employer or appropriate person. May arrange travel schedule and reservations. May compile and type statistical reports, computing amounts using adding machine or calculator. May oversee other clerical workers. May record minutes of staff meetings. Makes copies of correspondence or other printed matter, using copying or duplicating machine. May prepare outgoing mail using postage metering machine.

SPECIFIC ABILITIES

1. Typing ability
2. Spelling ability
3. Knowledge of English grammar and punctuation
4. Knowledge of vocabulary
5. Ability to communicate oral information clearly and accurately in English
6. Ability to compose correspondence
7. Reading speed and comprehension
8. Speed and accuracy of proofreading -- ability to compare two texts for exact likeness and identify discrepancies between the two
9. Speed and accuracy of simple arithmetic -- ability to add, subtract, multiply and divide whole numbers, decimals and fractions
10. Speed and accuracy in alphabetizing
11. Speed and accuracy of comparing lists of names or numbers for exact likeness -- ability to compare such lists and determine whether or not each item on one list has a 'match' on another list
12. Ability to attend to details -- ability to concentrate on components of job tasks, even when these tasks are routine or repetitive; being meticulous about accuracy in fine details of work
13. Ability to get along with people -- likeability; being outgoing and friendly
14. Ability to operate efficiently under pressure of deadlines
15. Job-task flexibility -- ability to shift quickly from one task to another in response to job demands, even if the first task is not yet completed
16. Ability to protect confidentiality of information -- ability to work with confidential information, such as

personnel files, without disclosing this information to others

GENERAL ABILITIES

1. **INTELLIGENCE:** General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgments. Closely related to doing well in school.
2. **VERBAL APTITUDE:** The ability to understand meaning of words and to use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.
3. **NUMERICAL APTITUDE:** The ability to perform arithmetic operations quickly and accurately.
4. **SPATIAL APTITUDE:** Ability to think visually of geometric forms and to comprehend two-dimensional representation of three-dimensional objects. The ability to recognize the relationships resulting from the movements of objects in space.
5. **FORM PERCEPTION:** Ability to perceive pertinent detail in objects or in pictorial or graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.
6. **CLERICAL PERCEPTION:** Ability to perceive pertinent detail in verbal or tabular material. Ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation. A measure of speed of perception is required in many industrial jobs even when the job does not have verbal or numerical content.
7. **MOTOR COORDINATION:** Ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make movement response accurately and swiftly.
8. **FINGER DEXTERITY:** Ability to move fingers, and manipulate small objects with fingers, rapidly or accurately.
9. **MANUAL DEXTERITY:** Ability to move hands easily and skillfully. To work with hands in placing and turning motions.

Appendix E

SECRETARY EXPERT ABILITY RATING FORM

This study is being done to determine whether people who are relatively unfamiliar with certain jobs can give accurate information concerning the skills and abilities needed in these jobs. To determine this, we need information from people who are familiar with these jobs (like you, for the job of secretary), against which to judge the accuracy of information provided by people unfamiliar with the jobs. The attached handout begins with a brief, general description of the secretary position, including the major duties defining the job. Following this description are lists of abilities, one list of abilities specific to this job and one list of more general abilities, which might be required for successful performance of the job. After you have read the job description, and based upon your knowledge of the job, rate the importance of each ability for job performance using the rating scale printed below. A blank has been left before each ability so that you can place the importance rating there.

- 1 -- Not important at all
- 2 -- Much less important than other abilities
- 3 -- Less important than other abilities
- 4 -- About the same as most other abilities
- 5 -- More important than other abilities
- 6 -- Much more important than other abilities

Schedules appointments, gives information to callers, takes dictation and otherwise relieves officials of clerical work and minor administrative and business detail. Reads and routes incoming mail. Locates and attaches appropriate file to correspondence to be answered by employer. May take dictation in shorthand or by machine and transcribe notes on typewriter or transcribe from voice recordings. Composes and types routine correspondence. May compute and verify totals on report forms, requisitions, or bills. Files correspondence and other records according to relevant filing system. May locate and remove material from files when requested. May handle confidential information. May enter data on records and dispose of obsolete files. Answers telephone, gives information to callers or routes call to appropriate official, and places outgoing calls. Schedules appointments for employer. Greets visitors, ascertains nature of their business, and conducts visitors to employer or appropriate person. May arrange travel schedule and reservations. May compile and type statistical reports, computing amounts using adding machine or calculator. May oversee other clerical workers. May record minutes of staff meetings. Makes copies of correspondence or other printed matter, using copying or duplicating machine. May prepare outgoing mail using postage metering machine.

- 1 -- Not important at all
- 2 -- Much less important than other abilities
- 3 -- Less important than other abilities
- 4 -- About the same as most other abilities
- 5 -- More important than other abilities
- 6 -- Much more important than other abilities

SPECIFIC ABILITIES

- _____ 1. Typing ability
- _____ 2. Spelling ability
- _____ 3. Knowledge of English grammar and punctuation
- _____ 4. Knowledge of vocabulary
- _____ 5. Ability to communicate oral information clearly and accurately in English
- _____ 6. Ability to compose correspondence
- _____ 7. Reading speed and comprehension
- _____ 8. Speed and accuracy of proofreading -- ability to compare two texts for exact likeness and identify discrepancies between the two
- _____ 9. Speed and accuracy of simple arithmetic -- ability to add, subtract, multiply and divide whole numbers, decimals and fractions
- _____ 10. Speed and accuracy in alphabetizing
- _____ 11. Speed and accuracy of comparing lists of names or numbers for exact likeness -- ability to compare such lists and determine whether or not each item on one list has a 'match' on another list
- _____ 12. Ability to attend to details -- ability to concentrate on components of job tasks, even when these tasks are routine or repetitive; being meticulous about accuracy in fine details of work
- _____ 13. Ability to get along with people -- likeability; being outgoing and friendly

- 1 -- Not important at all
- 2 -- Much less important than other abilities
- 3 -- Less important than other abilities
- 4 -- About the same as most other abilities
- 5 -- More important than other abilities
- 6 -- Much more important than other abilities

- _____ 14. Ability to operate efficiently under pressure of deadlines
- _____ 15. Job-task flexibility -- ability to shift quickly from one task to another in response to job demands, even if the first task is not yet completed
- _____ 16. Ability to protect confidentiality of information -- ability to work with confidential information, such as personnel files, without disclosing this information to others

- 1 -- Not important at all
- 2 -- Much less important than other abilities
- 3 -- Less important than other abilities
- 4 -- About the same as most other abilities
- 5 -- More important than other abilities
- 6 -- Much more important than other abilities

GENERAL ABILITIES

- _____ 1. INTELLIGENCE: General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgments. Closely related to doing well in school.
- _____ 2. VERBAL APTITUDE: The ability to understand meaning of words and to use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.
- _____ 3. NUMERICAL APTITUDE: The ability to perform arithmetic operations quickly and accurately.
- _____ 4. SPATIAL APTITUDE: Ability to think visually of geometric forms and to comprehend two-dimensional representation or three-dimensional objects. The ability to recognize the relationships resulting from the movements of objects in space.
- _____ 5. FORM PERCEPTION: Ability to perceive pertinent detail in objects or in pictorial or graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.
- _____ 6. CLERICAL PERCEPTION: Ability to perceive pertinent detail in verbal or tabular material. Ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation. A measure of speed of perception is required in many industrial jobs even when the job does not have verbal or numerical content.

- 1 -- Not important at all
- 2 -- Much less important than other abilities
- 3 -- Less important than other abilities
- 4 -- About the same as most other abilities
- 5 -- More important than other abilities
- 6 -- Much more important than other abilities

- 7. MOTOR COORDINATION: Ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make movement response accurately and swiftly.
- 8. FINGER DEXTERITY: Ability to move fingers, and manipulate small objects with fingers, rapidly or accurately.
- 9. MANUAL DEXTERITY: Ability to move hands easily and skillfully. To work with hands in placing and turning motions.

Appendix F

SECRETARY FAMILIARITY QUESTIONNAIRE

Please indicate the degree of familiarity which you feel you have with the following job, and the abilities that are required to perform it. Do this by circling the appropriate number on the scale.

SECRETARY

- | | | |
|---|---|---|
| 1 | — | Know nothing about this job. |
| 2 | — | |
| 3 | — | Know very little about this job. |
| 4 | — | |
| 5 | — | Know a moderate amount about this job, largely through TV shows and other such sources. |
| 6 | — | |
| 7 | — | Know a good deal about this job. Have known people who have worked this job. |
| 8 | — | |
| 9 | — | Know a great deal about this job. Have previously worked it myself. |

Appendix G

ANALYSIS OF VARIANCE SUMMARY TABLES

Table G1

Analysis of Variance Summary Table for Accuracy across
Familiarity Levels for Specific Abilities of the
Secretary Job

Source	df	SS	MS	F	p
Familiarity	2	0.0001	0.0001	0.001	0.9985
S/Familiarity	45	1.8275	0.0406		
Total	47	1.8276			

Table G2

Analysis of Variance Summary Table for Accuracy across
Familiarity Levels for General Abilities of the
Secretary Job

Source	df	SS	MS	F	p
Familiarity	2	0.0196	0.0098	0.150	0.8616
S/Familiarity	45	2.9441	0.0654		
Total	47	2.9636			

NOTE: Using VEC data as the criterion rating vector

Table G3

Analysis of Variance Summary Table for Accuracy across
Familiarity Levels for the Secretary Job

Source	df	SS	MS	F	F
Familiarity	2	0.2670	0.1335	2.760	0.0740
S/Familiarity	45	2.1764	0.0484		
Total	47	2.4434			

NOTE: Using expert-generated ratings as the
criterion rating vector

**The two page vita has been
removed from the scanned
document. Page 1 of 2**

**The two page vita has been
removed from the scanned
document. Page 2 of 2**