Task characteristics and individual differences in task design for computer-based clerical work.

Christian Andrew. de Keresztes

University of Windsor

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TASK CHARACTERISTICS AND INDIVIDUAL DIFFERENCES
IN TASK DESIGN FOR COMPUTER-BASED CLERICAL WORK

by

Christian A. de Keresztes

M.A., University of Windsor, 1983

A Dissertation
Submitted to the Faculty of Graduate Studies
through the Department of Psychology
in Partial Fulfilment of the
Requirements for the Degree
of Doctor of Philosophy at the
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1989
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ABSTRACT

It was proposed that the principal effects of computerization on job content in clerical work can be described in terms of increasing or decreasing task complexity and job decision latitude. The purpose of the study was as follows: (a) to investigate, in computer-based clerical tasks, the effects of variations in task complexity and job decision latitude on performance, subjective workload, and perceptual and affective responses to the work; and (b) to assess the effects of individual differences in abilities, personal control beliefs, and work preferences on reactions to task characteristics.

One hundred and thirty four female undergraduate students performed proofreading, text entry, and data entry tasks on a micro-computer. The subjects performed the tasks under one of four combinations of work conditions: low or high task complexity, and low or high job decision latitude. As hypothesized, subjects performed better when task complexity was low rather than high. The subjects reported lower workload when job decision latitude was high rather than low. With regard to perceptual and affective responses to the work, subjects in the high job decision latitude condition perceived their work to be lower in
complexity than subjects in the low job decision latitude condition. Predicted relationships between abilities, locus of control, and work aspect preferences were not observed. Contrary to predictions, neither ability or locus of control moderated perceptual and affective responses to the work. Consistent with predictions from theories of job enrichment, strong associations were observed between perceptions of high task complexity, meaningfulness, and skill-utilization, and intrinsic task satisfaction.

Implications of these findings for the psychologically-based design of computerized clerical work are discussed.
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Dr. Gary Reid, of the Armstrong Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, provided invaluable advice, training, and encouragement in the use of his Subjective Workload Analysis Technique. Our dialogue, conducted mainly through electronic mail, was enormously interesting and entertaining.

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John Stuurman wrote the BASIC programs to run the simulated work sessions at the heart of the study. He made elegant contributions and numerous enhancements to the specifications in the programming.

Gerry Bolger built the physical layout used in the experiment, showing his uncanny ability to imagine exactly what I needed before I could think of it.
To my subjects, thank you for your participation and your hard work.

A special tribute is due to my parents, who have always supported me and cheered me on in my lengthy education.

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CHAPTER I

REVIEW OF THE LITERATURE

Introduction

The purpose of this study was to investigate how different forms of task design in computer-based clerical work affect the way the work is experienced by people. Within the context of a laboratory experiment using simulated work tasks, this study examined the effects of variations in task characteristics on people's behaviour in computer-based clerical work. The goal of this research was to assess the behavioural effects of variations in task complexity and in job decision latitude, and the effects of individual differences in abilities and personal control beliefs on reactions to task characteristics. It is argued that information about the effects of alternative forms of task design for computer-based clerical work may increase our understanding of the match between people and jobs when implementing computer technology for office work.

The review of the literature will examine the following areas in relation to the hypotheses proposed in this investigation:

1. Job design and the experience of work.
2. Theories of job design.
3. Task characteristics and individual differences in job design.
4. Application of job design principles to computer-based clerical work.
Job Design and the Experience of Work

The organization of work has important and inevitable psychological consequences for workers. The design of jobs, through the allocation of tasks, defines the nature of the relationship between workers and the jobs they perform. Job design refers to the planning and modification of job content. It determines how the goals of the work are achieved and, implicitly or explicitly, how the work will be experienced by the worker. Many theories and techniques have been developed to alter job content by manipulating work methods, equipment, and work environment (McCormick and Ilgen, 1980, p. 337).

Since the advent of industrialization, the main purpose of work has been to maximize organizational outputs and only occasionally to meet human expectations. The purpose of a work system is to achieve products that meet organizational goals which express the values of its designers. Yet, those who do the work rarely design it, and those who design work systems often overlook workers' needs. Traditionally, these needs have been narrowly regarded as external to the work, rather than being inherent in the activity of the work itself. When needs are seen as external to the work, work activities have little value in and of themselves other than their instrumentality to the society or to the worker. The experience of work is not considered inherently important and worthwhile. The single-minded pursuit of organizational efficiency has generally been highly successful, but has
often been achieved at the expense of detrimental work experience. It has on occasion also been counterproductive, with the unexpected consequence of reducing organizational effectiveness. As a result, many jobs make only limited demands of human personalities and capacities and, by constraining behavior, provide few opportunities for training and growth (Buchanan, 1979, p. 3).

Efforts to alter job design in order to improve work experience have been made in response to the problems of industrial organization, and the humanistic belief that psychological development is in itself a worthy goal (Buchanan, 1979, p. 3). According to this view, work is of central importance as a human activity as it is the primary means of personality development in adulthood (Kohn & Schooler, 1983; Morf, 1986; O’Brien, 1986). This value position leads to the psychologically-based design of work organization. The aim is to create jobs that provide training which will develop cognitive and social capacities, along with the motivation that arises from their utility (Hacker, 1981). Here, the focus of job design widens from an exclusive emphasis on the products of work to also encompass its internal processes, that is, its mental structure and regulation (Meijman and O’Hanlon, 1984). Thus, this form of job design seeks to provide workers with increased control of their work environment, which must be distinguished from seeking ways to increase employee
influence in managerial decision-making; Buchanan, 1979, p. 10).

Theories of Job Design

Historical Trends in Job Design

The history of work improvement methods is probably as old as work itself. But the emergence of job design as a systematic rather than an evolutionary process has been comparatively recent. Begun during the Industrial Revolution, progress in job design has taken place mostly within this century. According to McCormick and Ilgen (1980), there are three major movements in systematic job design, which seem to have developed in sequence. The first is methods analysis, that is, the time-and motion study methods developed during the period of rapid industrial expansion in America at the turn of the century by the pioneers of scientific management. Their approach was to: (a) separate manual and mental labour, and (b) devise more efficient job methods by breaking jobs down into the simplest possible component tasks so that few skills and abilities were required to perform them. The desired effect of increasing productivity was achieved, but often at the expense of highly specialized, monotonous jobs and dissatisfied workers. The most influential exponent of the scientific management approach, Frederick Taylor, believed that workers were inherently lazy and primarily motivated by money. He envisioned that by making work as simple and as
effortless as possible, both labour and management would reap the advantages of a "larger pie", rather than fight over the "size of the slice", to use his metaphor. The concurrent development and use of mass production technology and of scientific management principles transformed the topography of the work environment, which changed the nature of work experience. Tasks were fragmented and deskilled, such that work became repetitious and monotonous for many workers in the industrialized world.

During and after World War II, a second movement in job design gained impetus with the rapid growth of technology. This is the field of ergonomics, which concerns the design of physical facilities and the work environment for optimal human use. Ergonomics has brought a psychological orientation to the worker-machine interface.

Most recently, job redesign through job enlargement and job enrichment has surfaced as a third movement. Job redesign reflects an apparently humanistic concern to reduce boredom and dissatisfaction fostered by increased mechanization. It has also been viewed as a means of improving productivity (Perrow, 1979; Kelly 1982a, 1982b). This humanistic concern has older roots which are often overlooked. That is, by the 1920's, the large-scale and often overzealous application of scientific management principles had created its own problems in productivity and morale. Managers sought remedies for these difficulties and
some turned to the newborn discipline of industrial psychology. The dysfunctional consequences of scientific management soon became a subject of avid study. As a result of production difficulties encountered in meeting wartime demands, pioneering studies were conducted by the British Industrial Fatigue Research Board. The purpose of these studies was to identify and reduce stressful physical working conditions in factory work. This research examined the problems of monotony and short cycles of work, and their adverse effects on the worker and on productivity (Wyatt, Fraser and Stock, 1928; 1929; in Buchanan, 1979, pp. 15-16). One of the proposed solutions was job rotation to increase variety, but without changing job content (Buchanan, 1979, p.17).

At about the same time, industrial engineers at the Hawthorne plant of the Western Electric Company began a series of studies on the environmental factors affecting productivity. The puzzling results—now famous as the "Hawthorne effect"—led to the accidental 'discovery' by two Harvard Business School professors, F.J. Roethlisberger and Elton Mayo, that the workplace is a complex social setting. Thereafter, social scientists broadened their horizons to study the social and the individual determinants and consequences of work. This new direction is exemplified in the landmark survey study of an automobile assembly plant conducted by Walker and Guest (1952). Their holistic approach to the workers' environment as a complex system,
and the scope of the questions which they sought to answer, provide the contemporary framework for inquiry into job design: "To what degree can-- or should-- men be 'adjusted' to machines, and to what degree is it possible to adjust or rebuild the environment to fit the needs and personalities of men?" (p. 3). Their findings underscored the deleterious effects of routine and repetitive work on job satisfaction, while their recommendations for job enlargement and job enrichment presaged subsequent inquiry into job design by both psychologists and industrial engineers (e.g. Salvendy and Smith, 1981).

Over the past three decades there has been growing concern about sagging productivity and low work satisfaction. This has been particularly evident in the fragmented, routine, and low skill-level jobs created to meet the demands of an industrial production economy. Interest in job design has accelerated rapidly with the shift toward the manipulation of information and toward the provision of services as the primary modes of economic activity. A concern for the experience of work is particularly important for the designers of man-machine systems, such as office information systems (OIS). Here, numerous factors must be weighed in determining the optimal ways of dividing work between the human operator and the machine. Contemporary approaches to job design that may be applied to computer-based clerical work will be reviewed,
with particular emphasis on the interaction of task characteristics and individual differences. These approaches are: (a) sociotechnical systems theory (Katz & Kahn, 1978), (b) Herzberg's two factor theory of job satisfaction (Herzberg, Mausner, Peterson & Capwell, 1957), (c) the job characteristics model (Hackman & Oldham, 1975), (d) activation theory (Scott, 1966; Gardner & Cummings, 1988), and (e) the congruence model (Barrett, 1978; O'Brien, 1986).

All of the theories of task design that are reviewed here are based in one way or another on a model of individual need satisfaction. As such, they have been criticized for substantive and empirical weaknesses. Pfeffer (1985) has argued that the individual is an inappropriate and incomplete unit of analysis in organizational research. The focus on individual job content (with the exception of sociotechnical systems theory) has tended to disregard broader organizational factors which may shape individual responses. By overlooking job context, most theory and research in job design has failed to recognize the powerful effects of normative and informational social influences on the perception of task characteristics and on the formation of attitudes to tasks. Further, theories of task design rarely mention nonpsychological factors such as how organization structure is determined by the relationship between the work organization and its environment). There are two sources of
support for this contention. First, there is the general failure to demonstrate that individual differences in needs moderate responses to task design (see reviews by O'Brien, 1986; White, 1978). This leaves needs-based theories of task design with indeterminate status. Second, there is cogent evidence from the investigation of social information processing in task design that: (a) attributes of the work environment can be defined in part by the perceptions of others; and (b) that individual needs and attitudes can be determined in part by information provided by others in the environment (O'Reilly & Caldwell, 1979; Pfeffer & Salancik, 1977; Salancik & Pfeffer, 1978; in Pfeffer, 1985; see also O'Reilly & Caldwell, 1985).

In spite of these criticisms of needs-based theories of task design, and without belittling the importance of social influences, it is argued that the individual is the relevant and appropriate unit of analysis for the study of work experience. Undoubtedly, many organizational variables cannot be operationalized at a phenomenological level, but this has also served to hinder investigation into the phenomenology of work. The present research focuses on job content, at the level of the individual, while trying to minimize and control contextual effects. It is proposed that the fundamental weakness of needs theories of job design has not been the concept of needs, but rather, the wrong needs concepts. That is, most existing approaches to
job and task design have not given enough attention to how the use of people's abilities in work may be a need with powerful motivating properties. Ultimately, a comprehensive model of job design will have to include both job content and job context factors, as well as their reciprocal interactions with worker characteristics.

**Sociotechnical Systems Theory**

The most popular contemporary approach to job design is sociotechnical systems theory (Katz & Kahn, 1978). The concept of a sociotechnical system is premised on the idea that any work organization has both a technological system of equipment and processes, and a social system of relationships among the workers who perform the necessary tasks. These technical and social systems are reciprocally interdependent (Schein, 1980). Sociotechnical systems theory is concerned with the design of work organization with a system of integrated and mutually-supportive social and technical aspects.

The sociotechnical approach to job design emphasizes the importance of meaningful work, worker control over task activities and, most of all, work group relationships. Sociotechnical systems theory provides practical guidelines for the human use of technology. Its applications have been widespread and notably successful (see Buchanan, 1979, and Katz & Kahn, 1978, for reviews). However, the units of analysis are the organization and the work group rather than
the individual, and the target of change is organizational structure. The sociotechnical approach does not directly address the nature of tasks and the experience of work at the level of the individual worker. If the experience of work is to be valued, then the individual should be a relevant and central unit of analysis, regardless of whether the target of change is job content or organizational structure.

In contrast to the molar orientation taken by Europeans toward work organization in sociotechnical systems theory, North American researchers and practitioners have adopted a more molecular perspective focused on job content. Here, the individual worker is the principal unit of analysis.

Herzberg’s Two-Factor Theory of Job Enrichment

Herzberg’s two-factor theory of job satisfaction and work motivation (Herzberg, Mausner, Peterson and Capwell, 1957) has undoubtedly been the most influential and controversial theory of job design in North America. This is in large part due to Herzberg’s original formulation of an explicit motivational basis to job design, and to his presentation of a general theory of the psychological experience of work (Buchanan, 1979). Herzberg and his colleagues interviewed a sample of engineers and accountants to elicit critical incidents in their work that were related to their job satisfaction. The resulting critical incidents yielded job factors which could be classified into two
independent categories: factors intrinsic in the job itself, which lead to job satisfaction, and factors extrinsic to the job, which lead to the avoidance of job dissatisfaction. Intrinsic factors included opportunities to experience responsibility, achievement, recognition, advancement, and the development of competence. Extrinsic factors included company policy, pay and working conditions. Herzberg concluded that the job characteristics which lead to satisfaction and dissatisfaction are qualitatively different.

Herzberg explained this difference by proposing that extrinsic and intrinsic job factors have different motivational bases. He postulated the existence of two kinds of human needs: "deficit" needs (e.g., adequate working conditions and pay), and "growth" needs (e.g., challenge and learning). There is an implied hierarchy among needs, in that higher-level growth needs become important only after lower-level deficit needs have been satisfied. Extrinsic job factors interact with deficit needs so as to reduce them, while intrinsic job factors interact with psychological growth needs (so as to increase them). People differ in the degree these needs are important. Nevertheless, Herzberg argued that the presence of intrinsic job factors in work is universally desirable, given that only true job satisfaction can lead to optimal performance.

Herzberg's two-factor theory has been the subject of
considerable research and controversy. His work has been criticized on logical, methodological and empirical grounds (see Locke, 1976). In particular, evidence for the existence of separate dimensions of satisfaction and dissatisfaction can be obtained only through the use of the critical incidents method. It has been argued that the results obtained are an artifact of the technique (Locke, 1976). Furthermore, it is questionable whether the pursuit of higher-order needs is universal. Two-factor theory has nevertheless endured as a popular heuristic, even in the face of considerable criticism. Herzberg defined job scope through the important distinction between horizontal and vertical dimensions of skill and ability used in jobs. Through job enlargement, job scope can be increased horizontally by increasing the number of subtasks without increasing responsibility or the use of skills. Through job enrichment, job scope can be increased vertically by expanding ability and skill requirements as well as responsibilities.

Job Characteristics Theory

The lasting contribution of Herzberg's work has been to emphasize the importance of job content as a determinant of job satisfaction and job performance. This idea was subsequently taken up by Hackman and his colleagues (Hackman and Oldham, 1975, 1976) in specifying the characteristics of jobs which influence internal work motivation. Hackman and
Oldham's theory of job characteristics which are conducive to high job performance and high job satisfaction has become the most widely used approach to job design in North American research and practice.

The origins of the job characteristics model can be found in a study by Turner and Lawrence (1965), who identified and developed measures for six "requisite task attributes" thought to positively influence productivity and job satisfaction. Turner and Lawrence found that differences between rural and urban cultures moderated relationships between task attributes and worker reactions to them. In field research on individual differences in reaction to job design, Hackman and Lawler (1971) subsequently studied five of Turner and Lawrence's task attributes. These task attributes, or characteristics are: (a) skill variety, (b) task identity, (c) task significance, (d) autonomy, and (e) feedback. Hackman and Oldham's (1976) definitions of these perceived task characteristics are presented in Figure 1. Hackman & Oldham (1976) found that people who rated their jobs as high in these five task characteristics also reported high levels of work motivation, job satisfaction, and had high performance and attendance records. Furthermore, employees who reported a high need for self-fulfillment, which was called high growth need (intrinsic) motivation, responded more positively to enriched jobs than employees who reported low growth need
Figure 1
The Job Characteristics Model

<table>
<thead>
<tr>
<th>CORE JOB DIMENSIONS</th>
<th>CRITICAL PSYCHOLOGICAL STATES</th>
<th>PERSONAL AND WORK OUTCOMES</th>
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<tr>
<td>Skill-Variety</td>
<td>Experienced Meaningfulness of Work</td>
<td>High Internal Work Motivation</td>
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<tr>
<td>Task Identity</td>
<td></td>
<td>High Quality Work Performance</td>
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<tr>
<td>Task Significance</td>
<td></td>
<td>High Satisfaction with Work</td>
</tr>
<tr>
<td>Autonomy</td>
<td>Experienced Responsibility for Outcomes of Work</td>
<td>Low Absenteeism and Turnover</td>
</tr>
<tr>
<td>Feedback</td>
<td>Knowledge of Results of Work</td>
<td></td>
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</table>

CORE JOB CHARACTERISTICS AND THEIR DEFINITIONS:

1. **Skill variety:**
   "The degree to which the job requires a variety of different activities in carrying out the work, which involve the use of a number of different skills and talents of the employee."

2. **Task identity:**
   "The degree to which the job requires completion of a 'whole' and identifiable piece of work— that is, doing a job from beginning to end with a visible outcome."

3. **Task significance:**
   "The degree to which the job has a substantial impact on the lives or work of other people—whether in the immediate organization or in the external environment."

4. **Autonomy:**
   "The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out."

5. **Feedback:**
   "The degree to which carrying out the work activities required by the job results in the employee obtaining direct and clear information about the effectiveness of his or performance."

CRITICAL PSYCHOLOGICAL STATES AND THEIR DEFINITIONS

1. **Experienced meaningfulness of the work:**
   "The degree to which the employee experiences the job as one which is generally meaningful, valuable and worthwhile."

2. **Experienced responsibility for work outcomes:**
   "The degree to which the employee feels personally accountable and responsible for the results of the work he or she does."

3. **Knowledge of results:**
   "The degree to which the employee knows and understands, on a continuous basis, how effectively he or she is performing on the job."

motivation (Hackman and Oldham, 1976, p. 255).

These findings led Hackman and Oldham (1975, 1976) to formulate the job characteristics model of job design. The job characteristics model (Figure 1) is a set of propositions about the relationships between perceived job characteristics, internal affective states and work performance. The model is built on the fundamental assumption "... that the reactions of task performers are determined by the perception of the task by the task performer rather than by 'objective' characteristics of the task (Algera, 1985, p. 131)". Specifically, these perceptions elicit three psychological states which are critical to high internal work motivation, satisfaction with work, and quality performance. The three critical psychological states are: (a) experienced meaningfulness of the work, (b) experienced responsibility for work outcomes, and (c) knowledge of results. These three critical psychological states are also defined in Figure 1. The links between "core" perceived job characteristics, critical psychological states and outcomes are hypothesized to be moderated by individual differences in growth need strength. People for whom growth needs are the most important source of work motivation perceive, and respond more strongly to, high levels of the core job characteristics than people who have low growth need strength. The theory makes the controversial contention that job enrichment should be reserved for workers who are high in intrinsic work
motivation.

Hackman and Oldham (1975, 1976) used Vroom’s expectancy theory of motivation as the foundation on which to build their approach to job design. Expectancy theory attempts to explain how and why individuals are motivated. It addresses the process of motivation, rather than the content of motivational needs, and provides a ‘motivational calculus’ to describe how an individual will tend to produce more when high productivity is perceived as leading to the attainment of valuable goals (Buchanan, 1979, p.63). Conversely, an individual will also tend to produce less if he perceives that low productivity leads to valued goals. A content theory of motivation, such as Herzberg’s two-factor theory, can be used to identify individual needs, and the outcomes that would be most valuable in meeting them.

To test their model, Hackman and Oldham designed a questionnaire called the Job Diagnostic Survey (JDS). The JDS consists of scales which measure the perceived presence of the five core job dimensions, the three critical psychological states, as well as affective responses to the job and individual growth need strength. The subscales of the JDS were found to have acceptable internal reliabilities and demonstrated construct validity in a large sample of workers in different jobs and different settings (Hackman and Oldham, 1971, in Hackman and Oldham, 1976, pp.108-109). The JDS is recommended by its authors for diagnosing
existing jobs in order to plan their redesign.

The majority of the research evidence available on the job characteristics model comes from correlational or quasi-experimental field studies (see Roberts & Glick, 1981; O'Brien, 1982, for reviews). Only one controlled experimental study appears to have been conducted to date (Umston, Bell, and Mitchell, 1976). The overall pattern of research results suggests that the predicted relationships between job characteristics, psychological states and outcome variables are weak, and at best marginally significant. Manipulations of job characteristics appear to be only moderately associated with satisfaction and motivation, and not at all with performance (Umston, Bell, & Mitchell, 1976). The critical psychological states do not determine job satisfaction as predicted by the job characteristics model (Wall, Clegg, & Jackson, 1978). There is also little evidence that Growth Need Strength moderates the relationships between job characteristics, psychological states and outcomes (Aldag & Brief, 1979; Hackman & Oldham, 176; Umston et al., 1976). Finally, the model has also been criticized for excluding potentially important variables such as age and job tenure, which may also moderate the relationship between job characteristics and work behaviour (O'Brien, 1982).

Part of the problem in empirical investigations of the job characteristics model may reside in the exclusive reliance on a single self-report measurement instrument, the
JDS. The item content of the JDS subscales measuring the various categories of variables is similar, which leaves open the possibility for common method variance (Schwab & Cummings, 1976). The theory assumes that the job characteristics are independent dimensions, but the job characteristic scales of the JDS are intercorrelated, which raises the question of whether the scales measure distinct constructs (O’Brien, 1982). The JDS items are similar in scale format and scale content (Roberts & Glick, 1981). Dunham (1976) factor analyzed the JDS and extracted only one factor with an eigenvalue greater than 1.00, which accounted for 83% of the variance in the item scores. A one-dimensional representation of the job characteristics as task complexity provided the most parsimonious interpretation of the relationship among the task characteristics. Even then, only one item loaded on the factor! Several studies have shown that the dimensionality of perceived task characteristics to be unstable (e.g., Fried and Ferris, 1986). O’Brien (1982) concluded that skill variety is the most unstable dimension because its definition as a construct confuses skill-utilization and job variety. In a more recent study, Idaszak and Drasgow (1987) revised the JDS by changing the keying direction for scoring some of the items. They replicated the a priori five factor solution of the core task characteristics suggested by the job characteristics model. Overall, the empirical support
for the propositions made by the job characteristics model is mixed, despite extensive research.

These mixed results point to ambiguous conceptual and operational definitions of the elements in the job characteristics model. Research has been based primarily on a single operationalization of its constructs— the JDS, which has questionable psychometric properties. Questions about the validity of the job characteristics model must be separated from those regarding the validity of its measurement operations. Answers to both sets of questions await a more psychometrically-refined measurement instrument combined with more rigorous experimental investigations. In the meantime, there are no alternative conceptualizations of job design of such depth and breadth in coverage. While job characteristics theory has received only moderate empirical support, it has nonetheless stimulated many practical applications as well as increased sophistication in theory-building. This suggests two possibilities: continue to use the existing theory, keeping in mind the criticisms, for lack of anything better; or, develop an alternative conceptualization based on empirically-defined task and person variables. The latter and more promising avenue might be to combine measurement of both objective and perceived task characteristics as well as individual difference variables with empirically established relationships to task demands.
Activation Theory

Scott (1966) has proposed a theory of job design based on neurophysiological activation to explain the frequently-observed problem of performance decrements in routine and repetitive work. Activation is a motivational construct that is defined as a set of hypothesized neurophysiological responses which regulate behaviour by enhancing attention and energizing performance. Activation is usually defined as the level of neural excitation in the Reticular Activating System (RAS) of the central nervous system (CNS). Anatomically, the RAS is a midbrain structure which has been identified as crucial in the regulation of consciousness states and behaviour (Thompson, 1975). Scott's (1966) activation theory of task design has been revised by Schwab and Cummings (1976), and by Gardner and Cummings (1988).

According to activation theory, each person has a characteristic activation level which allows for optimum neural functioning. For each person, his or her optimal level of neural functioning presumably leads to his or her most efficient behaviourial performance as well as his or her most positive emotional state, that is, mood and task satisfaction. Therefore, individuals are motivated to maintain their characteristic level of activation (Gardner & Cummings, 1988, p. 8). An individual experiences negative affect when activation differs from his or her characteristic level, and experiences positive affect when
activation approaches his or her characteristic level. Low and high levels of experienced activation relative to a person's characteristic level of activation are also hypothesized to reduce cognitive information processing capacity, and consequently, performance. Intermediate levels of activation lead to optimum performance. Thus, an inverse-U shaped relationship is hypothesized to exist between activation and behaviour, such that the highest performance and positive affect occur at the apex of the inverted-U. The apex is the characteristic level of activation. Figure 2a depicts the relationship between a person's optimal level of activation and performance.

The level of activation experienced by an individual covaries with stimulation (Scott, 1966, p. 12). That is, the kind and degree of stimulation from the external environment can cause variations in an individual's experienced activation level. Jobs differ in the nature and intensity of stimulation. Scott (1966) proposed that the nature and degree of stimulation offered by task characteristics affect the degree of experienced activation. He identified the following properties of task stimuli as capable of influencing activation level: (a) intensity, (b) variation, (c) complexity, (d) uncertainty, and (e) meaningfulness of the task. Gardner and Cummings (1988) retain a similar list of 5 task characteristics related to "job impact". Table 1 provides definitions of these
Table 1

Stimulus Properties of Tasks Which Affect Activation Level

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<th>Description</th>
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<tr>
<td>1</td>
<td>Stimulus intensity: &quot;The greater the intensity of a stimulus, the greater the frequency of impulses reaching the BSRF [RAS] (Scott, 1966). The degree to which one or a few sensory receptors of the same modality send neural impulses to the RAS&quot;.</td>
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<tr>
<td>2</td>
<td>Stimulus complexity: &quot;The degree to which a variety of sensory receptors send impulses to the RAS; the greater the number of different sensory modalities stimulated, the greater the complexity of the job&quot;.</td>
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<tr>
<td>3</td>
<td>Stimulus associativity: &quot;The degree to which sensory impulses impact the cerebral cortex and cue off neural associations in the cortex&quot;</td>
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<tr>
<td>4</td>
<td>Stimulus novelty: &quot;The degree to which job stimulation is unexpected, and/or has never been experienced before&quot;.</td>
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<tr>
<td>5</td>
<td>Variation in stimulation: &quot;The degree to which job stimulation varies sufficiently to prevent habituation processes in the RAS. The less repetitive/monotonous a job is, the less habituation [there is] to job stimulation&quot;.</td>
</tr>
<tr>
<td>6</td>
<td>Stimulus uncertainty</td>
</tr>
<tr>
<td>7</td>
<td>Stimulus meaningfulness</td>
</tr>
</tbody>
</table>

Figure 2(a). Level of Optimal Activation and Performance

Figure 2(b). Level of Optimal Activation and Performance for 2 Levels of Task Difficulty
Activation-modifying stimulus properties.

At work, stimulus underload or overload, or lack of control over stimulation may prevent workers from maintaining their optimal level of activation. In response to deviations in their experienced activation level, individuals will attempt to modify the impact of task stimulation in order to increase or decrease their experienced activation level in the direction of their characteristic activation level. Thus, the freedom to modify experienced stimulation at work is desirable because it allows individuals to regulate task stimulation in order to match it to their characteristic level of activation.

Results from both animal and human studies of activation and task difficulty indicate that the optimal level of activation decreases as task difficulty increases (Broadhurst, 1957; Sjoberg, 1977). This finding implies that simple jobs, which have low information processing (cognitive) requirements, require higher levels of activation than complex jobs. However, simple jobs also allow for maximum performance across a wider range of activation levels than complex jobs (Gardner & Cummings, 1988, p. 14), as shown in Figure 2b.

Few direct tests have been made of activation theory in relation to job design. Frankenheuser and Gardell (1976) examined the effects of work overload in a Swedish saw mill. People who worked in repetitive, machine-paced conditions which did not provide control over work stimulation,
exhibited a chronically high level of activation. This was inferred from self-reports of high activation and a corresponding elevation in the level of catecholamine secretion. These neurochemicals are regarded as physiological indicators of activation level. These responses were also associated with the development of emotional disorders, as well as psychosomatic and cardiovascular diseases. A recent experiment by Gardner (1986) compared performance and task satisfaction in a low-stimulation sorting task and a high-stimulation managerial in-basket simulation. Gardner found that subjects working on the nonstimulating task showed lower activation (as indexed by the visual threshold for the perception of continuous light) than subjects who worked on the stimulating task. He also found the predicted inverted-U shaped relationship between activation level and performance level in the stimulating task.

The research evidence has indicated moderate but consistent support for the principal job design propositions suggested by activation theory. Performance and task satisfaction appear to be optimal for moderate levels of activation. Optimal activation level appears to decrease as a function of task difficulty. There are nonetheless many problems facing the application of activation theory to job design. A major obstacle to research on activation level is that it is presently impossible to measure RAS activity in a
direct and non-invasive manner. Rather, activation must be inferred indirectly from physiological, experimental, and psychometric indices which have uncertain reliabilities and validities.

The degree of activation observed depends on the kind of stimulation (e.g. visual or auditory stimuli), and the response modality in which its effects are measured. The correlation between modalities is often low and not significant (Strelau, 1983; see also Kohn, Cowles, & Lafreniere, 1986 on arousal), which casts doubt on the validity of the activation construct as a unitary process. Relying upon activation as the principal source of motivation may be a practical oversimplification. Such a conceptualization does not represent the emerging multidimensional perspective on the physiological organization of emotion and motivation (e.g., Pribram, 1984). The activation concept is best regarded as a useful heuristic, while bearing in mind its explanatory limits.

The Congruence Model of Job Design

Relationship of Ability to Task Characteristics, Performance and Satisfaction

Theorists in the field of job design have focused mainly on the motivational bases of performance and satisfaction, and have assumed everything else to be equal. This strategy seemed appropriate as a means to isolate motivational effects in research. However, it ignored abilities, which are the principal determinants of
performance (Ghiselli, 1966; Schmidt & Hunter, 1983). A problem with much of the existing research on motivation is the possibility that motivation effects may be confounded with ability. In tests of motivational effects, performance-relevant ability that is not statistically controlled may become error variance (Huber, 1985). Since abilities are rarely assessed in job design research, there is little information about (a) their effects on performance, (b) the interaction of task characteristics with abilities, and (c) the effects of abilities on work performance and job satisfaction. Motivational variables do not contribute much to the prediction of job performance. However, there is evidence that abilities influence job satisfaction (Barrett, 1978). Abilities may provide a "missing link" to the relationship between task characteristics and work behaviour in job design.

One line of evidence relating abilities to task characteristics, performance, and affective responses in work can be found in the literature on vocational choice and work adjustment. Theories of vocational choice address the match between individual abilities and interests, and occupations in which they might be used in a way that is personally satisfying. Thus, the field of vocational guidance seeks to optimize the fit between the job and the individual in some way (McCormick, 1979). Theories of job design and theories of vocational choice (e.g. Holland, 1976; Lofquist & Dawis, 1969) share the common assumption
that a high degree of correspondence is desirable between the individual and his or her work environment. Ability is clearly an important factor in vocational choice. Theories of vocational choice explicitly recognize and consider the role of abilities in matching people with jobs. In their theory of work adjustment, Dawis & Lofquist (1968, in McCormick, 1979) consider vocational choice in terms of the correspondence between the individual and the environment. The degree of correspondence is determined by the match between individual abilities and needs with the ability requirements and reinforcer systems of the job (McCormick, 1979, pp. 220-223).

Schwab and Cummings (1976) have incorporated ability into the activation framework of job design. In their model, presented in Figure 3, task scope (i.e., objective task characteristics) influences employee performance by acting as an independent variable on the perceptions which determine work motivation, as well as by interacting with ability. Schwab & Cummings applied the Dawis et al. concept of correspondence to explain the relationship of ability to task scope and performance in job design. The abilities an individual brings to a task interact with the ability requirements imposed by the scope of the task (i.e., task characteristics). Schwab and Cummings posit an inverted-U relationship between ability to perform and task characteristics. Thus, an individual's relative ability to perform is greatest when the ability requirements of the
Figure 3. Schwab and Cummings Model of Activation

task match the individual's abilities (1976, p. 27). Each individual has an optimal task scope which maximizes his ability to perform, and the undermatching or overmatching of abilities and task demands decreases the ability to perform. Figure 4 illustrates the proposed relationship between relative ability to perform and task scope. The Schwab and Cummings model of job design highlights the previously neglected role of abilities as determinants of work performance in job design. Given that the model was developed to account only for performance, it also raises the question of how abilities are related to task satisfaction in job design.

O'Brien (1986) has argued that the degree to which a job engages a worker's valued skills may be an important determinant of his or her work satisfaction. When abilities and task demands are matched, the worker will likely experience the work as moderately difficult and challenging (O'Brien, 1986, p. 15). If a worker experiences a task as too easy, then he or she may feel underutilized. If a worker sees a task as too difficult, then he or she will feel overutilized.

Most existing programs of job design theory and research have failed to control for the effects of abilities when testing for task and motivation effects. At a minimum, ability may be confounded with motivation. Such confounding may increase error variance when measuring responses to task characteristics. There is also empirical evidence that
Figure 4. Task Scope, Ability, and Performance

abilities may have a substantive role in moderating the relationship between job design and job satisfaction.

The importance of abilities in job design has been investigated by Barrett and his colleagues. (Barrett, Bass, O’Connor, Alexander, Forbes, & Cascio, 1975; Barrett, Forbes, Alexander, O’Connor, & Balascoe, 1975; Barrett, 1978; Forbes & Barrett, 1978). Barrett and his colleagues conducted an extensive research program on job design and personnel turnover in routine maintenance and monitoring jobs in the United States Navy. From this research, Barrett (1978) has developed a congruence model of job design, which highlights the match or the correspondence between individual abilities and task characteristics. According to Barrett, the match between an individual’s abilities and task characteristics is the primary determinant of job performance and job satisfaction. The congruence model suggests that performance-relevant abilities are influential not only in determining performance, but also in determining preferences for certain task characteristics, and task satisfaction.

The principal postulate of Barrett’s congruence model is that: "...there is an optimal match or congruence among abilities, preferred [task] attributes, expectancies, and task complexity which will result in maximization of resources in terms of individual productivity, work satisfaction, and organizational tenure" (Barrett, 1978, p. 262). According to Barrett, preferences for task
characteristics are determined by both abilities and values. Specifically, preferences for learning new skills, job variety, and complexity are related to intellectual abilities. Preferences for responsibility and independence are related more to personality traits and to value orientations. These preferences for task characteristics create expectancies which interact with work experience to form perceptions of the work, and attitudes to it (1978, p. 264). The discrepancy between what is perceived and what is preferred is the main determinant of job satisfaction. Congruence theory predicts that "...task satisfaction is related to the proportion of an individual's abilities required by a given task" (Forbes & Barrett, 1978, p. 189).

Congruence theory advocates matching individual abilities with task requirements. The best person for a job, especially a low-level one, is not necessarily the one with the greatest ability. Rather, a moderate level of ability is preferable in that the job would be regarded as challenging, without being too easy or too hard. The implication for job design is that task demands should be equated with "the ability levels of the most capable individuals in the sample from which selection is made" (O'Connor, Barrett, & Alexander, 1977, p. 60).

Evidence to support the matching proposition made by congruence theory comes from both laboratory and field research. In a study of factors related to turnover among
United States Navy personnel working on maintenance and monitoring tasks, extended tenure was found to be associated with lower verbal and clerical aptitudes, and higher preferences for task characteristics, and satisfaction with the work (Barrett, Alexander, Bass, Forbes, O'Connor, & Cascio, 1975). Employees who reported a greater discrepancy between preferred and actual task characteristics were also less satisfied with their work. Forbes and Barrett (1978) conducted a laboratory investigation of abilities and task preferences in a monitoring task that was either high or low in complexity. Task-relevant abilities were identified for each level of task complexity by using hierarchical regression to predict performance from a battery of predictor measures. As predicted, the primary ability for the simple task was negatively related to satisfaction. In the complex task, satisfaction with the task was curvilinearly related to a composite of the abilities that best predicted task performance.

Summary
Overall, this empirical evidence supports the proposition made by congruence theory that task satisfaction is highest when the ability demands of the task are moderately challenging. The matching of abilities with task demands is a practical guideline for implementing job design. This matching process holds open the possibility of increasing the chances for successfully implementing job
design programs. Of theoretical significance, the congruence theory of job design provides a missing conceptual link in the integration of selection and job design strategies by giving explicit recognition to the role of ability as a determinant of both job performance and job satisfaction.

Personal Control Beliefs

Work Experience and Personal Control

In any job, worker behaviour is shaped and constrained by both the content and the context of the work. The situational influences that may impose demands upon the worker—e.g., task characteristics, the allocation of tasks, work procedures, goals and supervision—are all potential sources of external control to which the worker must adapt (O’Brien, 1986). Through the performance and experience of work, the worker may acquire beliefs about control that are congruent with the nature of control inherent in the organization and in the content of the work (O’Brien, 1986, p. 133). A worker who has considerable personal control in his or her work may come to value personal control. Conversely, a worker who is more externally controlled, and who has little personal control may be more likely to accept and to value external control.

The following review will examine and highlight the role of personal control beliefs in the performance and experience of work. The purpose of the presentation will be
to consider how job content can influence personal control beliefs, and how these in turn may affect work behaviour.

**Task Characteristics and Personal Control**

**Self-Directed Orientation**

An extensive program of survey research conducted by Kohn and Schooler (1983) and their colleagues has highlighted the role of job conditions and task characteristics in determining self-directed orientation. Their research began with a study of the relationship of social class to values in a large \((N = 3101)\) representative sample of working men in America. Kohn & Schooler found a positive correlation between social class and the degree to which people valued self-direction, which appeared to be accounted for by a cluster of working conditions which they defined as occupational self-direction. The working conditions associated with occupational self-direction were: (a) the substantive complexity of the work or the degree of independent thought and action required by the work, (b) the closeness of supervision, and (c) the degree of routinization. Work that was high in substantive complexity, but low in supervision and repetitiveness was associated with occupational self-direction, which in turn appeared to foster a self-directing orientation in the worker.

Kohn and Schooler observed that occupational self-direction was positively associated with a broad range of
psychological variables: job commitment, job satisfaction, self-direction outside of work, self-esteem and intellectual flexibility (Kohn & Schooler, 1973; Kohn, 1976; in O'Brien, 1986, p. 143). By using path analysis and causal modelling, they concluded that the reciprocal effects of jobs on personality were greater than the effects of personality on jobs. Subsequently, Kohn and Schooler applied confirmatory factor analysis and linear structural equation modelling to longitudinal data obtained from respondents in their initial sample. These analyses allowed for better control of potential error sources and provided a stronger basis for making causal inferences. Substantive complexity in work was found to have a reciprocal causal effect on self-directedness, intellectual flexibility, and psychological distress, and which, once again, extended to non-work activities as well.

Kohn and Schooler's research findings are particularly noteworthy because they indicate that job content influences the degree of personal control experienced not only at work, but more broadly as a stable disposition which affects experience and behaviour in nonwork spheres of activity. However, a limitation in Kohn and Schooler's research has been their use of constructed task and person variables whose definitions and validity are unclear (O'Brien, 1986, pp. 150-151). Their definition of self-directed orientation is based on a set of measures that need to be compared to established measures of similar concepts, such as locus of
control, and need for autonomy.

Locus of Control

People may form various beliefs about the source of control over the reinforcement of the outcomes of behaviour. For example, an individual may construe reinforcement in a given situation as consequent to his efforts, that is, where the cause, or locus of reinforcement is internal to the self; alternatively, an individual may perceive reinforcement to be a consequence of uncontrollable events which are external to the self. These beliefs have been addressed by means of the locus of control construct, developed by Rotter within the context of social learning theory (Phares, 1984). Locus of control refers to a generalized expectancy about whether reinforcement is under internal or external control.

The most widely used measure of locus of control is Rotter’s (1966) Internal-External (I-E) scale, which is made up of 29 forced-choice items. The total number of external responses to each forced-choice pair is summed. Low scores represent an internal locus of control, while high scores represent an external locus of control (Spector, 1982). Although the the I-E scale is psychometrically adequate (Phares, 1978), it has been criticized for not measuring expectancies in a wide range of situations (O’Brien, 1986). The Rotter scale may also focus undue attention on extreme internals and extreme externals, who may unrealistically
distort their perceptions of objective situations as sources of reinforcement for the outcomes of their behaviour.

Work experience and locus of control are reciprocally related (Spector, 1982; O'Brien, 1984b). That is, locus of control can influence work experience, and work experience can reciprocally influence locus of control. Locus of control appears to influence a broad range of behaviours at work, beginning with occupational choice. Internals are more likely than externals to put effort into career planning (Maracek & Frasch, 1977), and to seek careers and jobs which provide opportunities for using valued skills and for autonomy (Valecha, 1972). Once on the job, internals have been found to perform better than externals, in terms of immediate performance (Broedling, 1975; Hersch & Scheibe, 1967; Majumder, MacDonald & Greever, 1977) and also in terms of career success (Andrisani & Nestel, 1976; 1978; Hammer & Vardi, 1981); Heisler, 1974; Pandey & Tewary, 1979; Valecha, 1972). Internals may perform better on the job than externals because they exert greater effort as a result of having a higher expectancy that effort will result in successful performance. Internals are better than externals at learning and problem solving in complex tasks (Ducette & Wolk, 1973; Wolk & Ducette, 1974). Also, internals may use more information for problem solving at work than externals (Phares, 1968; in Spector, 1982). Most research showing performance differences between internals and externals may
confound locus of control with ability. When ability is controlled for, the relationship between locus of control and performance is not significant (Lied & Pritchard, 1976). The conclusion that internals perform better than externals is tentative and further research on locus of control should be conducted in which task-relevant abilities are controlled.

If internals exert more effort in their work and perform better than externals, they are more likely to experience the affective outcomes of work as being positive. Consistent with this hypothesis, internals appear to be more involved in their work than externals (Kimmons & Greenhaus, 1976), and they also report higher job satisfaction than externals in management jobs (Gemmill & Heisler, 1974) and non-management jobs (Lester & Genz, 1978; Munoz, 1973; Singh, 1978; in Spector, 1982). A possible confounding factor in much of this research may be that externals and internals may have held non-equivalent jobs (O’Brien, 1984a). Indeed, when jobs are equivalent as measured by objective indices, there is no difference between internals and externals in reported job satisfaction (Sims & Szilagyi, 1976). This raises the possibility that differences in tasks may influence locus of control perceptions, and thereby lead to increased or decreased performance and task satisfaction.

A number of studies have examined whether working conditions can influence locus of control. While the results are somewhat contradictory, they do indicate that
work experience can lead to shifts in locus of control. Anderson (1977) has shown that shifts in locus of control occur for internals and externals. Anderson administered locus of control measures to a group of businessmen 8 months and 42 months after their businesses were disrupted by a hurricane. Businessmen who were internals 8 months after the hurricane, and whose businesses were subsequently successful, were even more internal when they were next surveyed. In contrast, businessmen who were externals 8 months after the hurricane, and whose businesses subsequently declined in performance, became more external. Externals whose performance improved did not become more internal, and internals whose performance deteriorated did not become more external. In contrast, a laboratory study by Krolick (1979) found that locus of control scores for internals shifted toward externality after the experience of a failure, but that the locus of control scores of externals did not shift toward internality following the experience of a success. These studies show that variations in work experience can influence personal control beliefs, but do not provide any insight into what aspects of jobs might be responsible.

O'Brien (1984a, 1984b) has hypothesized that the job attributes which influence personal control orientation are (a) skill-utilization or match between employee skills and skills required by the job; (b) level of influence in work-
related issues; and, (c) income. He argued that people whose jobs provide them with opportunities to use valued skills and exercise influence are likely to become internally controlled. This would occur because people in such jobs would perceive their efforts as leading to valued intrinsic rewards. Conversely, people who work in jobs that neither use their skills nor allow them to exercise influence do not perceive their efforts as leading to valued intrinsic rewards. These people are likely to become externally controlled. Income, which is an extrinsic reward, should induce an external orientation if it is low, and an internal one if it is high.

O’Brien (1984b) tested his predictions in a cross-sectional survey study of 1383 Australian male and female employees working in a wide range of jobs. Using a form of regression analysis which permitted the assessment of reciprocal causality (two-stage least squares analysis), O’Brien found that locus of control and skill-utilization were reciprocally determined. Income and locus of control were also reciprocally determined, but contrary to predictions, influence and locus of control were not reciprocally determined. Influence was negatively correlated with locus of control, but not after controlling for ability. Thus, skill-utilization and income determined locus of control. O’Brien (1986) speculates that the experience of using valued, job relevant skills is sufficient by itself to maintain a belief in self-directed
control. He also concludes that skill-utilization is more important than influence in determining personal control, but it may be argued that his measure of influence mixes together different kinds of job decision latitude. Further tests are required of the influence hypothesis, using measures which more clearly distinguish between job decision latitude in job content and job context, and the relative importance of each.

O'Brien's research demonstrates that moderately complex tasks which use valued skills can enhance a sense of personal control, and that tasks which are not sufficiently challenging may reduce personal control. To be sure, the effect of skill-utilization on locus of control is small (less than 10 percent of variance accounted for; O'Brien, 1984a). Nonetheless, such a small proportion of variance accounted for is of substantive relevance, as the effect might be magnified over time.

**Self-Efficacy Beliefs**

Another kind of personal control beliefs describes the degree to which a person believes that he or she can successfully perform a given task. Bandura's (1986) theory of self-efficacy is an explanation of this kind of belief. Perceived self-efficacy is the judgment that a person makes about the ability to organize and to execute the action necessary to attain a given level of performance in a given situation (Bandura, 1986, p. 391). Such a judgment may also
be generalized and applied to many situations. Self-efficacy refers to what a person believes he or she can do with his or her abilities. As such, self-efficacy beliefs can be regarded as effort-performance expectancies, in contrast to locus of control beliefs, which represent performance-outcome expectancies. People who believe that they can perform well on a task have high self-efficacy, while people who believe that they cannot perform well have low self-efficacy. These beliefs are postulated to have an effect on performance that is independent of objective ability (Locke, Frederick, Lee & Bobko, 1984).

There is no single standardized measure of self-efficacy beliefs. Rather, Bandura (1986) advocates a microanalytic research strategy in which self-efficacy scales are constructed for the specific behavioural domain(s) under investigation. In such scales, the research subject designates the level of task performance that he or she believes is attainable, as well as the degree of certainty in performing at that level.

Bandura's theory of self-efficacy has yet to be systematically applied to investigating the effects of task characteristics on worker behaviour in job design. The utility of self-efficacy theory may depend on how clearly effort-performance expectancies and performance-outcome expectancies can be distinguished (O'Brien, 1986). Justification for theoretical interest in the self-efficacy
concept can be found in the underlying model of reciprocal causation of behaviour formulated by Bandura (1986). In this model, the person, behaviour, and the situation are regarded as reciprocally determined, such that each may influence the other. The concept of reciprocal determinism is potentially a useful framework for the explanation of reciprocal interactions between worker, work behaviour and the work environment. Furthermore, the microanalytic research strategy looks promising, particularly in view of O’Brien’s (1984a, 1986) criticism of inadequate situational specificity in existing measures of locus of control.

Summary

Personal control beliefs, in whatever way they are defined and measured, may influence responses to task characteristics. In turn, task characteristics can shape personal control beliefs. The demonstrated existence of this reciprocal relationship points to the utility of including personal control beliefs in explaining the effects of job content on work behaviour and work experience.

Task characteristics in job design

A major obstacle for job design theory has been the lack of a general theory of tasks with properly validated task constructs (Wood, 1986). Task characteristic
constructs in theories of job design have been derived either inductively, or from empirical analyses of individuals' perceptions of tasks, such as Herzberg's satisfiers and dissatisfiers, and Hackman and Oldham's (1980) core job characteristics. Such task constructs are likely to confound task and non-task elements by mixing together task attributes and individual attributes. Formal and objective definitions of tasks are needed in which tasks are specified a priori and then measured and tested empirically (Wood, 1986, p. 61).

According to Wood (1986), the analysis of tasks at the level of the worker must separate individual and task effects by describing tasks independently of the individuals who perform them. Wood identifies two approaches to task analysis which meet this criterion. One method is to define tasks through the pattern of stimuli with which the worker must deal. Task characteristics are dimensions based on the physical properties of the stimuli that make up the task (Wood, 1986, p. 61). However, task stimulation is usually a dynamic flow of information from many sources, and there is no a priori way of identifying which physical or collative stimulus dimensions need to be operationally defined. This is especially true of work that is primarily mental rather than physical in nature.

Another approach to defining tasks is in terms of the behavioural responses required to reach a specified level of performance on a given task. Behaviour requirements vary
from task to task, but are a relatively stable property of
tasks which can be defined independently of the task
performers (Wood, 1986, p. 63). If the products of a task
can be specified, then it should also be possible to specify
the behaviours required to achieve them. Both the task
stimulus approach and the behaviour requirements approach
can be combined in the theoretical analysis and development
of task constructs (Wood, 1986, p. 64). Wood argues that
any task can be defined with three basic building blocks:
(a) products, (b) acts, and (c) information cues. Task
products result from observable behaviours, and are
independent of the acts that produce them. Acts are defined
as patterns of purposive behaviour required to create
products. They constitute task components that can be
defined independently of an individual's behaviour.
Information cues are descriptions of the stimulus attributes
Any task can be described by its products and the inputs
needed to achieve them.

In the following review, Wood's task constructs will be
used to identify and describe two task characteristics: Task
complexity, and the degree of decision latitude available in
a task.

**Task Complexity**

The complexity of a task affects behaviour through the
ability demands that the task imposes upon the worker.
These demands influence many aspects of work behaviour such as: (a) performance, (b) perceptions of the task, and (c) the kind and degree of workload and satisfaction that the worker experiences. Tasks that are low in complexity can be described as simple and routine, with shorter job cycles. Such tasks require minimal abilities and "surface mental attention". Tasks that are high in complexity may be described as non-routine, and are associated with relatively longer job cycles and considerable ability requirements. In this section, task complexity will be defined as an objective task characteristic. Its effects on work behaviour will also be reviewed.

The construct of task complexity can be defined using Wood's (1986) terms as the relationship between the acts and the information cues required to accomplish a task. Wood (1986) has identified three types of task complexity and has provided an algebraic operational definition of each type:

1. The component complexity of a task is the number of distinct acts that are required for its performance (p. 66). This kind of complexity reflects the nature of the job cycle.

2. The coordinative complexity of a task refers to the nature of relationships between task inputs and task products (p. 68). This kind of complexity encompasses the ability requirements of a task.

3. The dynamic complexity of a task refers to the frequency
of cause-effect changes during the performance of a task (p. 71). This kind of complexity refers to changes across time in component complexity and/or coordinative complexity. The total complexity of a task can be calculated when the form of the relationship between the three types of complexity has been specified (p. 73).

Effects of Task Complexity on Performance

From the perspective of the scientific management approach, low task complexity is a desirable characteristic of production tasks. This is because it leads to increased performance and productivity. The simplification of jobs by fragmentation, specialization and deskilling is the result of the search for ways to maximize the efficiency of industrial production. It is beyond the scope of the present review to attempt a thorough and global evaluation of the scientific management approach to job design. Notwithstanding criticism by humanists and social scientists, the ideas and techniques of the scientific management approach remain firmly accepted by contemporary management because they are regarded as fundamentally correct (Locke, 1982).

Detrimental effects of excessive job simplification on work performance also have been documented. The pioneering studies of repetitive factory work by Wyatt and Fraser (1928, 1929) showed clearly how extreme repetitiveness reduced worker productivity, and how productivity could be
increased by introducing variety into the work. Another source of data comes from experiments of reaction time performance on simple motor and perceptual vigilance tasks over long time durations (i.e., several hours). In such tasks, psychological fatigue is manifested over time in the form of a gradual decrement or an increased irregularity in performance (Murrell, 1969).

More recently, research on task complexity has been conducted within the context of job redesign efforts to enrich jobs by increasing their complexity. In a laboratory study, Scott and Erskine (1980) investigated whether stimulus changes that are contingent on responses can increase activation and performance. They hypothesized that the effect of variations in task content on performance is determined by the number and type of response-produced reinforcing events in the task. The response consequences of complex tasks (high variety tasks) should be more reinforcing because of greater reinforcement variability. They used two visual matching tasks with identical motor responses, but with different response consequences. In both tasks, subjects compared four pairs of geometric designs presented in a series of arrays. They identified which of the four pairs did not match the others. Subjects in the repetitive visual stimulation condition (RVS) always saw and always responded to the same array of designs. Subjects in the variable visual stimulation (VVS) condition saw and responded to arrays of designs which varied in (a)
shape, (b) area, (c) heterogeneity, and d) arrangement on each trial. As predicted, the VVS subjects responded faster than the RVS subjects. The subjects in the VVS condition also reported experiencing (a) greater arousal, (b) higher task satisfaction and (c) the task as more attractive than the RVS subjects. These results show that the response-produced consequences of task stimulation are reinforcing if they are variable. When there is no variability in response consequences, it appears that the reinforcement potential of stimulus changes based on task responses decreases rapidly unless other, more durable, reinforcing events are available (e.g., extrinsic contingent reinforcers such as money; Scott & Erskine, 1980, p. 333).

Task complexity is frequently increased in job enrichment interventions. In job enrichment programs, increasing task complexity has been shown to increase performance quantity and quality (Katz & Kahn, 1978, p. 701). However, it is difficult to isolate the effect of change in task complexity in field studies because several task dimensions are usually modified at the same time.

In summary, data from laboratory studies of stimulus complexity and field implementations of job enrichment provide convergent lines of evidence for the phenomenon of performance decrements on simple, repetitive tasks and enhanced performance on complex and varied tasks.
Effects of Task Complexity on Work Experience

Job interest and job satisfaction are positively associated with increased task variety, which is a component of Wood’s task complexity construct. In their study of automobile assembly jobs, Walker and Guest (1952) examined the number of operations performed by each worker as an indicator of task variety. Workers’ interest in their jobs increased with the number of operations they performed. Morse (1953, in Katz and Kahn, 1978) conducted a study of employee morale at a large insurance company. Morse classified jobs according to level: high level technical, supervisory, varied clerical, or repetitive clerical. Forty-one percent of those performing repetitive clerical work reported low intrinsic job satisfaction in contrast to only seven percent of those who performed high level technical work. Shepard (1970) also found that functional specialization was negatively related to job satisfaction. Repetitive jobs may be disliked because they do not make use of worker abilities. Indeed, the underutilization of skills is the most frequently reported complaint in work that is repetitive and low in variety (Cox and MacKay, 1979; Grandjean & Taylor, 1980, in O’Brien, 1986).

Work underload and work overload are the result of insufficient and excessive task complexity, respectively. Both work underload and work overload are perceived as stressful (Johannson & Aronsson, 1981). Strain symptoms, such as elevated autonomic nervous system activity, are
often observed as a result of work underload conditions, characterized by monotony and repetition, and work overload conditions, characterized by external pacing, low job decision latitude, and high mental load (Cox, MacKay & Page, 1982; Frankenhaeuser and Gardell, 1976; Levi, 1972; Johannsson, 1981). In an epidemiological study (Caplan, Cobb, French, Van Harrison, and Pinneau, 1975; in Cox and MacKay, 1979), individuals working in routine and repetitive jobs reported experiencing greater stress reactions than workers in other occupational groups. This was due to underutilization of skills, lack of participation and lack of adequate job complexity. Frankenhaeuser and Gardell observed in a study of sawmill workers that the degree of repetitiveness in work was positively and linearly related to increased catecholamine excretion levels. Catecholamine excretion levels were also found to increase during the workday among workers employed at highly repetitive jobs with short job cycles. The levels decreased in a group of workers employed on less repetitive work with longer job cycles. Repetitive work was associated with greater fatigue, anxiety, and difficulties in communicating with family members.

Stress reactions to low complexity work extend beyond it, and are associated with long-term maladjustment in physical health, family relations, and leisure activities. Chronic exposure to either excessive or inadequate
stimulation input at work may lead to psychosomatic and cardiovascular diseases (Frankenhaeuser & Gardell, 1976, pp. 36-37).

In contrast to low task complexity, moderately high task complexity is often associated with positive worker attitudes. For example, Mann and Hoffman (1960, in Katz and Kahn, 1978) examined the effects of automating a public utility. As a result of automation, the remaining workers were given more duties and were more frequently rotated in different jobs. All reported that their new jobs were more interesting than their old ones. These workers reported much higher job satisfaction than workers at another plant in the same company which had retained the previous work arrangements.

Summary

The complexity of a task is clearly an important determinant of performance and productivity. Simplifying tasks may increase worker output. But, this high level of output may be difficult to maintain if the task does not engage a worker's valued skills, or if it does not provide reinforcing stimulus consequences. These factors appear to operate in the same way with respect to job satisfaction. Both very low and excessively high levels of task complexity are associated with low levels of satisfaction, while moderate levels of task complexity are associated with increased satisfaction. The data on job satisfaction
reported here generally conform to the prediction made by congruence theory that an inverse U-shaped relationship exists between task complexity and task satisfaction as a function of ability.

**Job Decision Latitude**

The nature and degree of discretion that a worker has in deciding how to meet job demands is an important determinant of work experience. Many jobs offer limited opportunities to make decisions, often because technology determines work procedures. Technological constraints may prevent workers from exercising discretion in controlling the pace and sequence of work activities, or in deciding how to go about them. Workers in jobs with rigidly specified rule structures frequently report low task satisfaction and show physical and psychological symptoms of strain (Frankenhaeueser & Gardell, 1976; Karasek, 1979). In contrast, artists, craftsmen, and managers often make many decisions in and about their work, including what goal to pursue. People who work in jobs which allow considerable latitude in decision making often report high task satisfaction (Kohn & Schooler, 1983), even when high job demands are high (Karasek, 1979).

Karasek (1979) has defined job decision latitude as the degree of potential control that a worker has over the tasks in his work and how to do them (pp. 289-290). The latitude in decision-making available to the worker is of central
concern to most theories of job design. Sociotechnical systems theory emphasizes the formation of autonomous work groups, whose members share responsibility for the decision making, planning, and execution of their work (Katz & Kahn, 1978). The purpose of autonomous work groups is to provide workers with increased control in adapting the work to individual and to group needs. In Hackman and Oldham's job characteristics theory, autonomy is identified as a core job characteristic which influences performance and job satisfaction by eliciting the critical psychological state of experienced responsibility for work outcomes. The terms 'job decision latitude' and 'autonomy' are equivalent, but the former is preferable because it is more easily identified (at least semantically) as a task characteristic than the latter, which more accurately describes how decision making latitude is perceived.

JDL may also be defined in Wood's (1986) behaviour requirements terms. Thus, the nature of JDL depends in part on whether, and to what degree, the worker was involved in determining the product of a task. JDL requires judgement and inferential acts. It is also likely that, as JDL increases, so do the number of information cues needed for acts. Thus, the degree of JDL can affect the component complexity of a task in the number of acts and information cues. JDL may affect the coordinative complexity of a task, through the interactions in sequencing and timing created by the acts and information cues used in making judgments.
Finally, changes in the acts and information cues used in making judgments about which task is to be done and how, can affect the dynamic complexity of a task.

In this thesis, the construct of job decision latitude (JDL) refers to the kind and degree of control in decision making that a worker has in a given task or job. JDL is defined by the technology, rules, methods, and supervision used by the work organization. Hacker (1981) has proposed a hierarchical classification of JDL which relates the nature of decision-making in work to the products, or goals, of the work. In Hacker's classification, which is shown in Table 2, the goals of the work task determine the kind of decision-making required from the worker. There are qualitatively different kinds of goals, which entail different levels of decision-making. The lowest possible level of JDL is worker control of the initiation and duration of the work cycle. At progressively higher levels of JDL, workers may make decisions concerning aspects of the product or work process, the sequence of operations, or the nature of the product and the goals of work. Low levels of JDL are often present in mass-production work, where tasks are routine, repetitive, and the cause-effect relationships are analyzable. Higher levels of JDL are usually associated with work in which tasks are non-routine and varied, and which have unclear cause-effect relationships, such as in research, management, and craft-type work.
Table 2
Hacker's Classification of Decision-Making in Work

<table>
<thead>
<tr>
<th>Job Decision Latitude</th>
<th>Possible Goals of Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>No JDL</td>
<td>?</td>
</tr>
<tr>
<td>JDL for pacing (C) or quantity</td>
<td>pacing</td>
</tr>
<tr>
<td>JDL for C + some aspects of product and/or process (P)</td>
<td>+ combination of properties</td>
</tr>
<tr>
<td>JDL for C + P + sequence of operations (S)</td>
<td>+ sequence of operations</td>
</tr>
<tr>
<td>JDL for C + P + S + method (M)</td>
<td>+ methods and procedures</td>
</tr>
<tr>
<td>JDL for C + P + S + M + fundamental properties or nature of product</td>
<td>+ properties/nature of product and problem</td>
</tr>
</tbody>
</table>

Job decision latitude can be operationally defined at each level of decision making identified by Hacker through the number and the kind of rules used in work. Pacing may be regarded as the kind and the degree of external control versus worker control over the start and duration of the job cycle (Dainoff and Hurrell, 1981). Work that is paced by the worker provides relative flexibility and freedom to decide how the work is to be done. Work that is externally paced removes the opportunity to make decisions by specifying very narrowly what has to be done and how. Human-paced work may be (a) highly unpaced, (b) socially paced, (c) self paced, or (d) incentive paced. Factors that influence external pacing include (a) the degree of automation of the length of the work cycle, (b) buffer stocks, and (c) continuous or discrete starting and processing of the work (Salvendy, 1981, pp. 6-7).

Freedom in decision making is intrinsically motivating, in that it permits the worker to use valuable skills (O'Brien, 1986). As job decision latitude increases and external control diminishes, more knowledge and abilities can be used or acquired (Hacker, 1981, p. 201). Abilities may lose their motivating value once they have been developed. It may be that only the possibility to learn is motivating (Hacker, 1981).
Effects of Job Decision Latitude on Performance

Productivity is the main reason for machine-paced work. The scientific management view is that simplifying work by separating mental and physical tasks leads to increased productivity. Proponents of job enrichment argue that self-determination should improve productivity by increasing personal responsibility for work (Hackman and Oldham, 1975). The research evidence supports the scientific management view and suggests that high JDL may have detrimental effects on performance.

Morse and Reimer (1956) conducted an exceptionally rigorous field experiment to determine the effects on productivity and job satisfaction of increasing the power and authority of lower level employees working in a company department. The experiment was conducted over a one year period, with pre and post measures of productivity and morale. The design of this study is particularly interesting because the experimenters created opposing treatments by manipulating authority in the direction of tighter control. Four divisions of a company department were used: Two of the divisions were assigned to an "autonomy" program and the other two were assigned to a "hierarchically controlled" program. All experimental groups increased their productivity—by 20% for the groups in the autonomy program, and by 25% in the hierarchical program. The employees in both treatment conditions apparently benefitted from the attention of managers and
researchers.

Cosier and Aplin (1983) investigated the effects of delegated choice on performance in a decision making task. Undergraduate business majors were assigned to one of four combinations of goal (subject's choice or assigned) and schedule conditions (subject's choice or assigned). Contrary to expectations, assigned goals led to better performance than chosen goals.

Farh and Scott (1983) investigated the effect of variation in autonomy on performance and job satisfaction. In their experiment, autonomy was defined as the degree of discretion in deciding the sequencing of subtasks and the duration of time spent on each subtask. Undergraduate subjects worked on proofreading, coding and grading tasks under one of four levels of autonomy. Subjects in the autonomous condition had latitude in choosing their activities, while subjects in the nonautonomous condition were given very specific instructions about what to do. The nonautonomous subjects were yoked to the autonomous subjects in order to equate time spent on each task. While the subjects in the autonomous condition reported feeling more autonomous and productive than the subjects in the nonautonomous condition, their response rate was significantly lower. The apparently detrimental effect of autonomy on performance appears to have been due to subjects spending more time making decisions in the autonomous
condition.

There is some evidence that machine paced work results in lower performance than self paced work. The negative effects of machine paced work include (a) slower response times (Murrell, 1963), (b) shorter periods of optimum performance (Murrell and Forsaith, 1962), (c) increases in non work-related movements (Salvendy, 1972), and (d) increased errors (Salvendy, 1972; Salvendy and Humphreys, 1979). In contrast, McFarling and Heimstra (1975; in Beith, 1981) found that self paced subjects detected more errors and defects in a simulated quality control task than machine paced subjects.

In summary, the data from both laboratory and field research generally indicate that low JDL is associated with increased performance and productivity. The available results fail to support social scientists' best intentions to improve productivity through changes in work design meant to provide greater opportunities for self-determination.

Effects of Job Decision Latitude on Work Experience

Most, but not all, workers dislike externally paced work. Walker and Guest (1952) classified level of pacing in the sample of automobile factory workers they studied. They found that job satisfaction decreased as machine pacing increased. The more directly that work pace was determined by the assembly line, the lower was the job satisfaction reported by workers. In a survey of job stress among 3000
machine-paced letter sorting operators, Hurrell and Smith (1981) found that the major source of stress reported by the workers was task dissatisfaction. Perceptions of the task as boring were associated with low work-related self-esteem, which in turn was associated with reports of increased anxiety and depression. In a study of factory workers, Salvendy, McCabe and Sanders (1979) reported that three quarters of the workers preferred self-paced work, while one quarter were satisfied with machine-paced work. About 15% of the sample in the Walker and Guest (1952) study stated having a preference for machine-paced work. There appears to be a small group of workers who like external pacing in their work, but there is no information available about how these workers differ from those who prefer self pacing.

Some research has found that job decision latitude does not affect job satisfaction. Farh and Scott (1983) found that autonomy had no effect on semantic differential ratings of job satisfaction. In an experiment to increase worker participation in a Volvo assembly plant, the majority of workers liked their new work arrangements. However, a buffer stock system to reduce the demands of machine pacing was not as flexible as had been intended. Workers reported only a small increase in opportunity for direct influence in their work and expressed a desire for more (Katz and Kahn, 1978). In the Morse and Reimer clerical experiment (1956), clerks in the autonomy program reported increased self-actualization and better relationships with supervisors, but
they did not report any change in their job satisfaction.

Laboratory studies of intrinsic motivation are relevant to understanding the relationship between job decision latitude and job satisfaction. Intrinsic motivation is manipulated in the laboratory by providing subjects with increased opportunities for deciding how to work on a task, which often consists of solving a puzzle. High job decision latitude provides self control over task performance, which should result in increased intrinsic work motivation. Fisher (1978) manipulated JDL by giving one group of subjects puzzles in which they could determine their performance across a wide range of possibilities, while a second group of subjects was given puzzles in which choices were constrained to a small range of potential outcomes. The subjects who set their own performance goals were more intrinsically motivated, as evidenced by greater willingness to work on the puzzles in their free time. Another study by Zuckerman, Porac, Lathin, Smith, and Deci (1978) also predicted and found a similar effect by manipulating the amount of self-determination experienced by subjects. Pairs of subjects were given puzzles to solve. One member of the pair was allowed to choose which of the puzzles to work on, while the second subject was assigned puzzles and given directions on how to solve them. In comparison to the subjects who were assigned puzzles, The subjects who were allowed self-determination were more
intrinsically motivated to work on the puzzles, as evidenced by spending more time on the task and by greater readiness to participate in further research.

High job decision latitude is usually associated with increased job satisfaction. More laboratory and controlled field research is needed given the difficulty of isolating the effects of job decision latitude in field settings.

Summary

The bulk of the evidence from both laboratory and field studies indicates that conditions of high job decision latitude in externally paced work lead to decrements in performance over time. Working conditions of high job decision latitude allow the worker to choose an appropriate behavioural strategy for regulating incoming stimulation, but may also result in lower work performance. It is not yet clear whether the adverse effect of low job decision latitude is due to the increased time required to make individual decisions that would otherwise be specified. What is clear is that not all, but most workers prefer high job decision latitude. The opportunity for self control engendered by working conditions with high job decision latitude is reliably associated with greater job satisfaction than in working conditions which are low in job decision latitude. Provision for job decision latitude in job design is clearly important for the experience of work.
Interaction of Task Complexity and Job Decision Latitude

Thus far, the effect of the interaction between task complexity and JDL has received very little attention in research. Investigators have often assumed task characteristics to be orthogonal (e.g. Hackman & Oldham, 1975; Farh & Scott, 1983). However, perceptions of task characteristics measured by JDS are often highly intercorrelated (Dunham, 1977; Hackman & Oldham, 1980; O'Brien, 1982). Some argue that these high intercorrelations are due to the existence of a latent underlying construct (e.g., Dunham, 1976; Hulin & Roznowski, 1985), or that they are artifacts of poor construct specification and measurement error in the JDS (O'Brien, 1982). Even when the a priori factor structure of five task factors is replicated by using a psychometrically refined version of the JDS (reversed response key removed for two items), there remains a moderate correlation between autonomy and skill variety ($r = .37$; Idaszak & Drasgow, 1987). If task characteristics are associated in perceptions, then they should also be associated in how they influence other behaviours. The forms of such relationships remain to be investigated.

Increases in JDL also increase task complexity because more abilities are required for making decisions and solving problems. Such work conditions may lead to new behaviour patterns on and off the job. Ideally then, the correlation between job demands and JDL should be high. That the
correlation is sometimes found to be low implies that there are work situations in which many workers experience a discrepancy between task complexity and JDL. Job demands and job decision latitude may interact in a non-linear way, such that considerable latitude in decision-making may reduce the undesirable effects of heavy job demands (Karasek, 1979). When both task complexity and job decision latitude are low, there may be a decline in activity and problem-solving ability. It is also possible for work to be high in skill demands and low in decision authority, but this appears to be a rare combination (Karasek, 1979).

Karasek (1979) has proposed that job demands (or workload, which is a function of task complexity as described earlier) and job decision latitude are related in that the opportunity to use skills and make decisions reduces the negative consequences of job demands. Karasek factor-analyzed job content items from American and Swedish national stress surveys, and extracted two stable factors which he interpreted as job demands and job decision latitude. Analyses of both cross-sectional and longitudinal data supported his propositions about the interaction between task dimensions and job satisfaction. Furthermore, Karasek argues that job demands and job decision latitude are also related to performance via the output level and the authority structure set by the organization.
Applied Context: Computer-Based Clerical Work

Office Automation

Office automation is an umbrella term which refers to the application of microelectronics technology to office work. A major impetus for office automation comes from advances in computer hardware and software, and communications switching and transmission. The end result is a convergence of three technologies which have traditionally been separated in the office: (a) data processing technologies, such as computers; (b) office technologies such as typewriters, copiers and dictation machines; and (c) communication technologies, such as the telephone. A second impetus toward office automation comes from managerial drives to increase office productivity, which has remained stagnant during a period in which industrial productivity has grown by leaps and bounds (Strassman, 1985).

The development of computers has made possible the vision of a post-industrial or "information-age" office. The capabilities of this new technology include the removal of conventional time and place requirements and the potential to reorganize the office so as to match work to the abilities and needs of the worker. Most descriptions of the office of the future emphasize technology. However, the organizational and social characteristics of the automated office will not necessarily reflect the flexibility of the new information technology (Iacono & Kling, 1984). The way
Office system planners perceive automation strongly shapes how the technology is implemented. The implementation of office automation technology expresses the assumptions and intentions of those it is designed to serve (Zuboff, 1982). Office automation provides a set of tools which can be used in different ways. Computerization offers choices, and managers implement office automation to create the kind of workplace they desire. The introduction of computers can, through the design of work, positively or negatively affect the way people experience their work by either increasing or decreasing opportunities to use skills and make decisions (Driscoll, 1982; Jackson, Coutts, & Knight, 1987).

Two Scenarios for Office Automation

Discussion of the impact of office automation adds fuel to a debate that has simmered since the beginnings of industrialization. The introduction of machines in the workplace polarized arguments into two camps: (a) those which favour computers because of their benefits in easing physical labour and increasing productivity; and (b) those against computers because of the loss of jobs and deskilling that they might bring about. Essentially the same arguments about technology that pitted Luddites against mill owners in the nineteenth century are at the core of the contemporary controversy over the role of computers in work. These arguments are currently espoused by two schools of thought.
on computerization, whose positions Zeeman and Russell (1980) have respectively called "optimistic" and "pessimistic". The optimistic perspective is that computer technology will generate wealth and employment, while the pessimistic perspective foresees large-scale structural unemployment, along with impoverished working conditions for most of those remaining in the work force.

Each of these opposing perspectives on the future of the computer in the office gives rise to a distinctive scenario for the consequences of the technology for the organization and the worker. In the optimistic scenario, office automation will improve the effectiveness of the organization. The purpose of technology is to assist information workers in augmenting their abilities to better perform their broad functions. In the pessimistic scenario, the purpose of computerizing office work will be to reduce costs and to increase the efficiency of elemental tasks, such as typing and filing. While these scenarios are associated with different consequences, they are not mutually-exclusive. Actual situations may reflect elements from both scenarios.

Effects on the Organization

The optimistic scenario envisions the creation of new forms of "post-industrial" work organization (see Giuliano, 1982; Hammer & Sirbu, 1980; Tapscott, 1982). Work flow would be radically altered to fully exploit the
possibilities offered by the new technology. The technology will be applied toward increasing the effectiveness of office workers in fulfilling the underlying functions and goals of office work. In the functionally-oriented office, all workers will have access to terminals, to information in central data bases, output devices, and internal and external communications equipment. The technology will be a set of tools to be used by the worker for the tasks that make up his or her functions. Workers will thus be free to focus on the fundamental purpose of their work, rather than on the procedures involved (Hammer & Sirbu, 1980). Most routine and highly structured tasks will be automated and eliminated. Work will be facilitated and enlarged so that individual workers will be able to work more autonomously. These changes imply decreased task specialization and a less hierarchical structure of work organization.

The pessimistic scenario is described by its critics as merely an extension of industrial forms of work organization. The main reason for implementing office automation is cost reduction. In order to maximize production, the bulk of office costs will be shifted from labour to equipment. Cooley (1980) describes computerization as a "Trojan horse for Taylorism" through which mistakes made in the design of manual work will be repeated in the design of intellectual work. Others echo this view. Gregory and Nussbaum (1982) envision the office
of the future as "...electronic, paperless, and people-less as possible (p. 203)." The application of the principles of industrial work organization to work in the electronic office will allow management to exert greater control through discipline and standardization in an area where this was previously not possible. Here, the effect of technology on organizational structure would be to reinforce the existing hierarchy of authority through an increased division of labour.

Effects on the Worker

The optimistic scenario envisions that office automation will augment the worker's abilities and, consequently, the effectiveness of the information worker, through improved access to information, new and better forms of communications, and decision-support systems (Tapscott, 1982). The widespread use of computers in the office will bring about significant improvements in the quality of work experience:

"Work can become more interesting, challenging, and fulfilling. Because an employee spends less time doing non-useful, frustrating work s/he can simply do more of what is important and, hopefully, rewarding" (Tapscott, 1982, p. 24).

Skill demands will increase because work will require more intellectual concentration. Physical skills and interpersonal behaviour may become less important, while "...patterns of attention, learning, and mental engagement become the keys to effectiveness and high quality
performance" (Zuboff, 1982, p. 152). Workers will have greater discretion and responsibility in making decisions and in carrying out their functions. Freedom from the drudgery of performing routine tasks and increased individual control imply that workers at all levels will be able to do more interesting, varied and unstructured work. Workers will have more ability and authority to devise, to improvise, and to modify procedures for handling unusual situations (Hammer & Sirbu, 1980). Office workers may become more like craftsmen than assembly line workers. Computerization will also open up new career paths, thereby providing new opportunities for developing skills on the job, and clerical workers may be elevated to the status of paraprofessionals.

According to the pessimistic scenario, clerical jobs will be further fragmented to maximize the volume and the speed of production. The control which computers can provide over previously skilled clerical workers leads to the deskilling of their jobs. Increased physical restrictions may isolate clerical workers from each other and cut them off from contact with employees at different skill levels (Gregory & Nussbaum, 1982, p.216). Taken together, these working conditions are likely to foster job dissatisfaction and generate occupational stress.
Office Automation, Clerical Work, and Job Design

The two scenarios suggest that the advent of office automation may affect both professional and clerical workers in many ways. Indeed, the effects of computers in upgrading or reducing the skill requirements for office work have already been observed (Buchanan & Boddy, 1982; Jackson, Coutts, & Knight, 1987). Office automation technology is likely to have a greater impact on the work opportunities and work experience of clerical workers, because structured and predictable work is more amenable to automation. Many clerical jobs will be lost to automation, and the nature of those that remain may be radically altered. Job content in the electronic office will be determined by job design, through the allocation of tasks to people and machines, and by the ergonomics of the software. The principal effects of office automation technology on job content will be manifested in changes in task complexity and changes in job decision latitude. Using the technology to make clerical work more efficient by simplifying it further will reduce task complexity and job decision latitude. The adverse effects of such working conditions on work experience have previously been described. There is reason to believe that such conditions will not lead to sustained increases in productivity. The underuse of worker abilities may impose limitations on productivity gains, and may lead to impoverished work experience. In contrast, efforts to increase the effectiveness of office functions by increasing
the skill demands and responsibilities placed upon clerical workers may enhance their work experience. The matching of ability levels with task demands, along with increased opportunities for individual control and regulation of working conditions should be desirable to the worker and, in the long run, to the organization as well.

**Goals of the Study**

It has been argued that, for theories of job design to advance, a framework of objective task constructs is first needed. One such framework can be found in Wood’s (1986) proposal to define tasks in terms of their behaviour requirements. The complexity of the task and the degree of decision latitude in a task are two task characteristics which can be defined in terms of variations in behaviour requirements. The research literature on the effects of these two task characteristics shows that they are important job content determinants of work performance and of work experience.

The review of the literature suggests that the congruence model (Barrett, 1978; O’Brien, 1986) is a promising theoretical approach for understanding the relationship between job content and the individual in job design. The congruence model attempts to locate the cause of worker responses to job content in task constructs, such as the ability requirements of tasks, that can be defined objectively. The congruence model describes how the match
between abilities and task demands may moderate the relationships between task characteristics, performance and work experience.

The effects that different forms of work organization in the computerized office may have on clerical work call for an investigation of the effects of those aspects of job content that are most likely to change. In clerical work, the new technology has the potential to increase or decrease task complexity and to increase or decrease job decision latitude. Accordingly, the proposed study will explore the consequences of variations in the job content of simulated computer-based clerical work on work performance and work experience. Particular emphasis will be placed on the interaction of task characteristics with individual difference factors.

The goals of the research are as follows:
1. Measurement of the effects of task complexity and job decision latitude and their interaction on work behaviour in computer-based clerical work.
2. Testing hypotheses regarding individual differences in response to task design for computer-based clerical work using abilities, the match or congruence between abilities and task demands, and personal control beliefs. This will permit the evaluation of the importance of individual differences in abilities and personal control in task design for computer-based clerical work.
Hypotheses

Effects of Task Characteristics

Effects on Performance

There is a tradeoff in outcomes between job design for maximum performance and job design for maximum worker satisfaction. Neither the job simplification nor the job enrichment approaches can assimilate this tradeoff. Each of these two approaches emphasizes one outcome over another, and is more successful at predicting what it emphasizes. Therefore in assessing the effects of job design for computer-based clerical work, the job simplification approach should yield the best prediction of performance effects, while the job enrichment approach should yield the best prediction of psychological effects.

Hypothesis 1.1a:

Task performance will be higher in the low task complexity conditions than in the high task complexity conditions.

Hypothesis 1.1b:

Performance will be higher in the low job decision latitude (JDL) task conditions than in the high JDL task conditions.

Effects on Subjective Workload

The designers of man-machine systems are expressing growing interest in the effects of machine and task design on mental workload. The reason for this interest is that
the demands that a task imposes on a worker’s resources may or may not correspond with performance (Wickens, 1984). If adequate performance for a task requires more from the worker than the worker can provide, then performance will deteriorate. The degree of mental workload that a worker experiences provides a way of gauging the psychological effects of performance demands imposed by variations in task characteristics. The concept of mental workload is defined as the relationship between the worker’s resources in ability and attention, and the demands of the task. High task demands increase workload by reducing the worker’s reserve resources (in ability and attention) available for performance. The measurement of workload may be a more sensitive indicator of task effects than the measurement of objective performance because variations in a worker’s response to task demands might be apparent in workload before they are reflected in performance. It is expected that the subjective experience of workload will vary as a function of task complexity and job decision latitude. If worker control of work pace and work sequence allows for accommodation of individual differences in work behaviour, then JDL should interact with task complexity such that high JDL should reduce the negative effects of high task complexity on workload.

Hypothesis 1.2a:
Subjective workload will be highest when task complexity is high.
Hypothesis 1.2b:

High job decision latitude will result in lower subjective workload than low job decision latitude.

Effects on Task Perceptions and Affective Responses to Work

The review of the literature on job enrichment has shown that high task complexity and high job decision latitude result in the most positive affective responses to work. High task complexity, which provides increased opportunities to learn and to use abilities, should be preferred over low task complexity. High job decision latitude should be preferred over low job decision latitude. Worker control of work pace and work sequence allows for more opportunities to so as to adjust individual responses to it.

Hypothesis 1.3:

Affective responses to work will be most positive when both task complexity and job latitude are high.

Preferences for Task Characteristics

Barrett's (1978) congruence model posits that ability determines performance and that ability determines preferences for task complexity and learning new skills. Personality and attitudes are the main determinants of preferences for job decision latitude. In the present study, it is proposed that individual differences in
personal control beliefs are related to the degree of preference for JDL. Therefore, it is hypothesized that:

**Hypothesis 2a:**

The higher the level of ability, the greater are the preferences for job complexity, variety and learning new skills.

**Hypothesis 2b:**

Internals will show a greater preference for high JDL and a greater preference for high task complexity than externals.

**Effects of Abilities on Task Perceptions and Affective Responses to Work**

Congruence theory predicts that ability moderates the relationship between task characteristics and task satisfaction. The match of ability with task requirements is a determinant of job satisfaction. The mismatch between ability and task requirements (moving from the optimum in either direction) will result in lowered job satisfaction (Barrett, 1978). The form of the relationship between ability and task satisfaction depends on the demands which a task places upon the subject’s relative abilities. When task complexity is low, people with low abilities will experience the most positive affect. When task complexity is high, people with moderately high levels of ability will experience the most positive affect. If the level of ability exceeds that which is required by
the task, then underuse of abilities may result in more negative affect. If the level of abilities is below that demanded by the task, then work overload will also lead to negative affect. Following from Barrett's model then, it is hypothesized that:

**Hypothesis 3a:**

In the low task complexity condition, there will be a positive linear relationship between ability and performance. There will also be a negative linear relationship between abilities and affective responses to the work.

**Hypothesis 3b:**

In the high complexity task condition, task-related ability will be curvilinearly related to task satisfaction. People with low and high levels of abilities will have more negative affective responses to the work, while people with moderate levels of abilities will have the most positive affective responses to the work.

**Effects of Personal Control Beliefs on Work Performance and Work Experience**

The review of the literature has shown that internals tend to perform better at work than externals. This difference may be accentuated in task conditions which provide opportunities to use skills and to have influence in how the work is done, because these are favourable to holding beliefs in personal control. If personal control
beliefs influence work performance, then the predicted performance differences between internals and externals should be evident after controlling for task-relevant ability. If internals perform better than externals when task complexity and JDL are high, they should also have more positive affective responses to the work than externals.

**Hypothesis 4a:**

Internals should perform better than externals in the high JDL task conditions and also in the task complexity conditions, but not in the low task complexity and low JDL task conditions.

**Hypothesis 4b:**

Internals should have more positive affective responses to the work than externals, when task complexity and JDL are high. Internals and externals are not predicted to differ in affective response in the low task complexity and low JDL task conditions.
CHAPTER II

METHOD

Subjects

The subjects in the experiment were 134 female university students enrolled in first-year introductory psychology and second-year developmental psychology courses. Given that clerical work is largely feminized (Iacono & Kling, 1985), an exclusively female sample was selected in order to eliminate extraneous variance due to gender differences.

The subjects, who ranged in age from 18.00 to 50.07 years, volunteered to participate. In return, the subjects received course credit points and information from scales measuring their work-related attitudes.

Because of the importance of correct vision for working on computers, the subjects were asked to indicate whether they had any vision problems. All subjects reported normal or corrected-to-normal vision.

Design of the Study

The layout of the experiment consisted of a split-plot factorial analysis of variance design (Kirk, 1982, p. 489) with two fixed factors and a randomized factor. The fixed factors were task complexity and job decision latitude. There were two levels of task complexity (high complexity and low complexity) and two levels of job decision latitude.
(JDL; high JDL and low JDL). The random factor was time allocation. The manipulation of job decision latitude might be confounded with time allocation if all subjects chose their own sequence of task and the time they spent on each task. Accordingly, time allocation was isolated as a nuisance variable, by matching (blocking in analysis of variance terms) subjects for sequence and for time on task across JDL. The low JDL subjects were yoked to the high JDL subjects for the sequence of tasks as well as for the time spent on each task. The subjects in the high JDL condition were free to choose the sequence of tasks to work on as well as the amount of time spent on them. Thus, each high JDL subject was matched with a low JDL subject who was assigned the same sequence of tasks and the same duration of time on each task. Each yoked pair of subjects was treated as a block in the experimental design, and the blocks were treated as a random factor. The blocking of time allocation served to increase the precision with which the JDL effect was measured, but at the cost of reducing the precision with which the task complexity effect was measured. This is so because there were two error terms in the split-plot design: an error term for task complexity, and an error term for JDL and for the interaction of JDL and task complexity. The design of the study is illustrated in Figure 5. Subjects were randomly assigned to one of the four conditions in which they performed simulated clerical tasks on a microcomputer.
Figure 5: Experimental design of the study.
Procedure for Selection of Tasks

The tasks selected for the simulation were identified as being representative of the principal functions and activities of clerical work. Functions and activities involving primarily social interaction were excluded so as to isolate the job content of clerical work.

In order to understand the reasons for which office activities are performed, functions were taken as the basic element of office work. Tasks and procedures can best be understood in terms of the functions that they were designed to fulfill (Hirschheim, 1985). In the present study, an analysis of the functions of clerical work was used to evaluate the consequences of the optimistic and pessimistic scenarios for office automation. Functional analysis was also used to identify the relevant task characteristics. Predictions about changes in the job content of clerical work as a result of automation were used to develop the manipulations of the task characteristics of task complexity and of JDL. An analysis of office activities was used to select the types of tasks in which job content was varied.

Taxonomies of office activities focus on (a) what activities office workers perform, (b) the proportion of time spent on each activity, (c) and who performs each activity. This information was useful for identifying which tasks may be supported by technology. It does not provide any insight into why they were performed (Hammer & Sirbu,
1980; Hirschheim, 1985). Information obtained about office activities does not differentiate employee workload levels. For example, managers and secretaries may spend roughly the same amount of time writing and talking on the telephone, although what they actually do when writing or talking on the phone is very different.

Data from taxonomies of office activities were examined to identify the most common tasks in clerical work (Christie 1981; Dodswell, 1983; Engel, Groppuso, Lowenstein & Traub, 1979; Stewart, 1967; in Hirschheim, 1985. Knopf, 1982; Thachenkary and Conrath, 1982; in Helander, 1985). Because the activity categories, data collection methods, and samples varied from study to study, only the most frequently performed tasks reported in each study were compared. More specifically, a criterion of 20% or more of the time spent on an activity was applied to certain tasks from the above listed studies. This criterion was judged to indicate that an activity was a significant aspect of clerical work. Tasks which were performed 20% or more of the time in all the activity studies reviewed were retained. The tasks identified in this way are presented in Table 3. Inspection of Table 3 indicates that the principal clerical tasks were related to document creation. This involves typing, manipulating, and verifying text and data. Accordingly, the following tasks were considered representative of this domain:
Table 3

Clerical Worker Activities

<table>
<thead>
<tr>
<th>Classification of Activity</th>
<th>% of Time on Activity</th>
<th>Worker Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>(From: Engel, Groppuso, Lowenstein &amp; Traub, 1979)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typing</td>
<td>37%</td>
<td>Secretaries</td>
</tr>
<tr>
<td>Routine Transactions</td>
<td>23%</td>
<td>Clerks</td>
</tr>
<tr>
<td>Calculation/data processing</td>
<td>16%</td>
<td>Clerks</td>
</tr>
<tr>
<td>(From: Stewart, 1967)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document creation</td>
<td>60%</td>
<td>Secretaries</td>
</tr>
<tr>
<td>Document creation</td>
<td>40%</td>
<td>Clerks</td>
</tr>
<tr>
<td>Document handling</td>
<td>20%</td>
<td>Secretaries</td>
</tr>
<tr>
<td>Document handling</td>
<td>40%</td>
<td>Clerks</td>
</tr>
<tr>
<td>(From: Christie, 1981)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading, writing, dictating, researching, filing, copying, proofreading</td>
<td>31%</td>
<td>Non-management</td>
</tr>
<tr>
<td>(From: Thachenkary &amp; Conrath, 1982)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bookkeeping, accounting, calculating, inventorying, invoicing</td>
<td>49%</td>
<td>Non-management</td>
</tr>
<tr>
<td>(From: Knopf, 1982)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Document processing</td>
<td>42%</td>
<td>Non-management</td>
</tr>
<tr>
<td>Document processing</td>
<td>55%</td>
<td>Secretary</td>
</tr>
</tbody>
</table>

1. Creation of text: Keyboard entry task
2. Data processing: Data entry task
3. Verification of information: Proofreading task

Laboratory simulations of these tasks were developed for this study so as to incorporate variations in the two principal task characteristics affected by the two scenarios for office automation.

Task Complexity

The complexity of a task is determined by the acts and information cues which a worker must use in order to achieve a product. Specifically, the manipulations of task complexity can be guided and assessed by the number of acts and information cues, and the relationships between them. For this experiment, tasks were developed with high and low levels of complexity. Tasks with a low level of complexity had fewer behavioural requirements, while tasks with a high level of complexity had more behavioural requirements, in terms of the number of acts, information cues, and interactions in sequencing and timing. Different acts and different information cues are varied for each task, as described below. Sample stimulus materials and instructions are presented for the proofreading, text entry, and data entry tasks in Appendix A, B, and C, respectively.

Proofreading Task A:

The low complexity version of this task consisted of proofreading text on-screen and comparing it to a
'correct' original paper draft, on which the errors were marked in red ink. The subject made the corrections on the computer monitor screen.

Proofreading Task B:
The high complexity version of this task consisted of proofreading text on the microcomputer monitor screen to find the errors embedded in it (same errors as in simple version). Subjects then made the necessary corrections. This task was judged to require more acts and more information cues than the simple version.

Keyboard Entry Task A:
The low complexity version of this task consisted of entering a series of documents (letters and memos), and working from complete and correct "rough" drafts on paper.

Keyboard Entry Task B:
The high complexity version of this task consisted of composing the documents on the computer monitor screen, given the necessary information about content, and format. This task was judged to require more acts and more information cues than the simple version.

Data Entry Task A:
The low complexity version of this task was to record daily financial transactions into journals/accounts. Working from bundles of transaction records sorted according
to the journals/accounts to which they belong, the subjects entered financial data into the computer on a specially-configured accounting screen. Like the other simple tasks, this task consisted mainly of keyboard entry.

**Data Entry Task B:**

The complex version of this task required subjects to first analyze each transaction in order to determine into which type of account it was to be recorded. After sorting the transactions into the appropriate accounts, the financial data were entered into the computer files. This task was judged to require more acts and more information cues than the simple version.

**Job Decision Latitude**

Job decision latitude refers to the kind and degree of control in decision-making that a worker has in a given task or job. There are several qualitatively different levels of job decision latitude. At the lowest level of job decision latitude, the worker is able to control the initiation and duration (pacing) of the work cycle. At progressively higher levels, workers may make decisions concerning aspects of the product or work process, the sequence of operations, or even the nature of the product.

Since job decision latitude is positively correlated with task complexity, high levels of job decision latitude might increase the complexity of the tasks, but not necessarily in a linear fashion.
In the high JDL condition subjects chose the order of tasks they worked; they were instructed to change tasks whenever they desired. The sequence of the tasks and the duration of time that these subjects chose to work on them was recorded by the computer program. In the low JDL condition, subjects were assigned the sequence of tasks to work on as well as the duration of the work on each task by being randomly paired with a subject from the high decision latitude condition. For subjects in the low job decision latitude condition, the experimenter programmed the duration and sequence of tasks at the beginning of the session.

**Instructions to Subjects for Job Decision Latitude Manipulation**

In the high JDL condition, subjects chose the sequence of tasks and worked at their own pace. The instructions for this condition were as follows:

"Like many jobs, the tasks which make up a job need not always be performed in the same sequence. In this job, you must work on each task for a period of 15 minutes. However, you can switch tasks whenever you want. Remember, you are free to switch tasks when you want, provided that you work 15 minutes on each."

In the low JDL condition, subjects were assigned the sequence of tasks and the duration of tasks of the high JDL subject with whom they were paired. The instructions were as follows:
"Like many jobs, the tasks which make up the job should be performed in some definite sequence. In this job, you will be instructed as to when and which task you are to perform."

Measures

Demographic Background Questionnaire

Subjects completed a questionnaire (Appendix D) to provide information about age, school and work experience, and eyesight. The subjects were asked to indicate their experience in using computers. Subjects who indicated having experience in using computers were also asked to rate their enjoyment of computers on a five-point Likert scale.

Abilities

Measures of task-related abilities were administered to the subjects prior to working on the simulation. These measures were used to test whether task-related ability predicted both performance and task satisfaction.

Task-related abilities were identified through analysis of ability requirements of the simulation tasks. The specification of abilities for each of the tasks is presented in Table 4.

Multidimensional Aptitude Battery

The Multidimensional Aptitude Battery (MAB; Jackson, 1983) was constructed for group testing of intelligence. The MAB is composed of ten subtests which correspond to ten
<table>
<thead>
<tr>
<th>Task</th>
<th>Complexity</th>
<th>Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyboard</td>
<td>Simple</td>
<td>Visual-motor coordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keyboard/typing skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perceptual</td>
</tr>
<tr>
<td></td>
<td>Complex</td>
<td>Visual-motor coordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keyboard/typing skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perceptual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocabulary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verbal comprehension</td>
</tr>
<tr>
<td>Proofreading</td>
<td>Simple</td>
<td>Visual-motor coordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keyboard/typing skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perceptual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attention to detail</td>
</tr>
<tr>
<td></td>
<td>Complex</td>
<td>Visual-motor coordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keyboard/typing skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perceptual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attention to detail</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Grammar, spelling, punctuation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocabulary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Concentration</td>
</tr>
<tr>
<td>Accounting</td>
<td>Simple</td>
<td>Visual-motor coordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keyboard/typing skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perceptual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attention to detail</td>
</tr>
<tr>
<td></td>
<td>Complex</td>
<td>Visual-motor coordination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keyboard/typing skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perceptual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attention to detail</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verbal comprehension</td>
</tr>
</tbody>
</table>
of the eleven subscales of the Wechsler Adult Intelligence Scale (WAIS). The MAB does not include the Digit Span subtest from the WAIS, as this subtest shows the lowest correlation with any of the WAIS factors. The MAB scales are listed in Table 5. Six subtests assessing abilities specified in Table 4 were selected from the MAB on the basis of relevance: (a) Comprehension, (b) Arithmetic, (c) Vocabulary, (d) Digit Symbol, (e) Picture Completion and, (f) Spatial.

An advantage of using the MAB is the extensive information available on the nature of its subscales and from related research on the WAIS-R. The Kuder-Richardson estimates of internal consistency reliability were used for these subscales because the overall test yields separate Verbal, Performance, and Full Scale composites (Jackson, 1983), which differ slightly in range across age groups: .94 to .97 for the Verbal Scale, .95 to .98 for the Performance Scale, and .96 to .98 for the Full Scale. The retest reliabilities are .95, .96, and .97 for the Verbal, Performance, and Full Scale scores, respectively. Evidence for the construct validity of the MAB subscales can be found in a comparison of the factor structure of the MAB subscales with that of the Wechsler Adult Intelligence Scale-Revised (WAIS-R). The congruence coefficients between the MAB and WAIS-R were .97 and .96 for factors V (Verbal) and P (Performance).
Table 5

Multidimensional Aptitude Battery Subscales

<table>
<thead>
<tr>
<th>Verbal scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Information</td>
</tr>
<tr>
<td>2. Vocabulary</td>
</tr>
<tr>
<td>3. Arithmetic</td>
</tr>
<tr>
<td>4. Comprehension</td>
</tr>
<tr>
<td>5. Similarities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Picture Completion</td>
</tr>
<tr>
<td>2. Picture Arrangement</td>
</tr>
<tr>
<td>3. Block Design</td>
</tr>
<tr>
<td>4. Object Assembly</td>
</tr>
<tr>
<td>5. Digit Symbol</td>
</tr>
</tbody>
</table>

Keyboard Typing Skill Test
At the end of the tutorial on how to use the computer, and prior to starting the work session, subjects were given a paragraph to type. Typing speed and error rate were computed for use as measures of keyboard typing proficiency.

Personal Control Beliefs

Locus of Control
The locus of control construct was measured with Dutteiler’s Internal Control Index (ICI; 1984; see Appendix E), which consists of 28 items designed to measure where a person looks for, or expects to obtain reinforcement. The items are scored on a five-point scale ranging from "rarely" to "usually". Responses to the items are summed; low scores represent an internal locus of control, while high scores represent an external locus of control. The internal consistency reliability, as measured by Cronbach’s alpha, was reported as .84 to .85 for the normative samples (total N = 1365). No test-retest correlations were reported. A factor analysis of the scale identified two factors, labelled self-confidence and autonomous behaviour, respectively. The Internal Control Index (ICI) was chosen to assess locus of control over the Rotter (1966) scale, because the ICI’s item content was more closely related to work behaviour than the Rotter scale.
Work Preferences

Work Aspect Preference Scale (WAPS)

The Work Aspect Preference Scale (WAPS) was developed by Pryor (1983) to assess the qualities of work that individuals consider important to them. Pryor equates the importance of work characteristics to an individual with his or her own pattern of preferences for different work characteristics. The WAPS is a 52-item inventory of dimensions that people consider important in work. The inventory is made up of thirteen subscales, each having four items. The subscales are listed below, and a sample booklet of items is presented in Appendix F. The subscales of the WAPS are listed below:

1. Independence
2. Co-Workers
3. Self-Development
4. Creativity
5. Money
6. Life Style
7. Prestige
8. Altruism
9. Security
10. Management
11. Detachment
12. Physical Activity
13. Surroundings
Respondents are asked to rate the importance of each work aspect item on a discrete five-point scale. Subscale scores are computed by summing the scores for each of the four items in each subscale.

The WAPS subscales demonstrated adequate internal consistency reliability (median scale coefficient using the Spearman-Brown split-half formula = 0.78), and test-retest stability (median scale coefficient = 0.74). The WAPS manual (Pryor, 1983) presents data on the construct, content, and concurrent validities of the subscales. Pryor (1987) has reported further evidence for the stability of the WAPS work preference dimensions across different samples.

In the present study, the principal subscales of interest were Independence, Self-Development, and Creativity. Subjects' raw scores on the Self-Development subscale were taken as indices of the importance they placed on skill-utilization. Subjects' scores on the Independence and Creativity subscales were taken as an index of the importance they placed on job decision latitude.

Task Perceptions

**Michigan Organizational Assessment Questionnaire (MOAQ)**

The Michigan Organizational Assessment Questionnaire (MOAQ: Seashore, Lawler, Mirvis, & Camman, 1982; in Cook, Hepworth, Wall, & Warr, 1981) was chosen to assess perceptions of task characteristics. The MOAQ is based on
similar constructs as the two best-known measures of task perceptions-- the Job Diagnostic Survey (Hackman & Oldham, 1975) and the Job Characteristics Inventory (Sims, Szilagyi, & Keller, 1976). However, the MOAQ measures a broader range of task characteristics that may also be more clearly defined. The MOAQ provides nine subscales to assess perceptions of Task Characteristics, of which the following have been included in the present study (see Appendix G for items):

1. Variety (3 items, alpha 0.81)
2. Freedom (3 items, alpha 0.71)
3. Pace Control (3 items, alpha 0.83)
4. Task Feedback (2 items, alpha 0.54)
5. Training Adequacy (1 item retained from 3-item scale)
6. Task Significance (2 items, alpha 0.45)

The MOAQ also includes the following four subscales which measure Psychological States:

1. Challenge (4 items, alpha 0.81)
2. Meaningfulness (2 items, alpha 0.50)
3. Responsibility (2 items, alpha 0.41)

The response format is a seven-point scale. The internal consistency reliability coefficients for these scales range from 0.41 (Responsibility) to 0.83 (Pace Control).

Since the Freedom and Pace Control subscale items have been found to load on the same factor (Cook, Hepworth, Wall, & Warr, 1981), the scores from these two subscales
were used as indices of perceived job decision latitude. Subjects’ perceptions of Variety was used to represent the variety component of task complexity.

**Skill-Utilization**

According to congruence theory, the match between abilities and task demands is an important predictor of job satisfaction. This match can be assessed in two ways: (a) objectively, in terms of the relationship between abilities and task satisfaction as a function of task complexity; and (b), by asking people to rate their perceptions of the match between their skills and the level of skill required by the job. O’Brien (1980; O’Brien & Dowling, 1980) has developed a scale of perceived skill-utilization composed of 4 items rated on a five-point scale. Scores on this scale have been found (Humphrys, 1981; O’Brien & Pembroke, 1982; O’Brien & Stevens, 1981) to correlate highly and positively with the Work Itself scale of the Job Descriptive Index by Smith, Kendall, and Hulin (1969). A factor analysis of the skill-utilization scale and other scales of perceived job attributes has shown that skill-utilization forms a factor that is distinct from influence, variety, pressure, and interaction. The Scale items are presented in Appendix H.

**Measures of Performance**

1. **Proofreading Task**

   The same performance criteria were used in both the
Simple and Complex conditions of the Proofreading task to assess quantity and quality of performance. These are:

- total number of lines scrolled (3 errors/page)
- number of errors corrected.

2. Keyboard Entry Task

The following performance criterion was used in both the Simple and Complex conditions of the Keyboard task to assess quantity of performance:

- total number of lines entered.

The following performance criteria were used in both the Simple and Complex conditions of the Keyboard task to assess quality of performance:

- number of spelling mistakes
- number of punctuation mistakes.

3. Data Entry Task

The following performance criteria were used to assess quantity and quality of performance in both the Simple and Complex conditions of the Accounting task:

- total number of entries
- number of correct entries.

The scoring of these data was performed by the computer program.

Subjective Workload

Few efforts have been made in previous job design research to study the complex cognitive effects of task
characteristics on behaviour. Yet, methods are available, and the resulting information may clarify the nature of the relationship between task characteristics, performance, and affective responses.

The construct of mental workload was defined as the relation between the worker's available resources and task demands: "if adequate performance of a task demands more resources from the operator than are available, performance will break down. If, on the other hand, the supply exceeds the demand, the amount of this excess expresses the amount of residual capacity (Wickens, 1984, p. 311)." Workload may be a more sensitive indicator of task effects than objective performance indices (Wickens, 1984). For example, increasing task demands might be evident in increased workload before being reflected in decreased performance. If this is true, then workload ratings may show a higher correlation with task satisfaction than objective performance criteria. The workload construct might provide an explanatory linkage between objective and perceived task characteristics, as well as between task characteristics and affective responses.

There are many techniques for assessing workload. Most of these either infer workload from direct measurement of task performance, or infer it from the worker's residual capacity available to perform a secondary task. In recent years, subjective ratings of workload have become increasingly popular. From the perspective of the worker,
subjective ratings of effort and demands are particularly appropriate for investigating the effects of work (Wickens, 1984).

**Subjective Workload Assessment Technique (SWAT)**

The Subjective Workload Assessment Technique (SWAT; Reid, Eggemeier & Shingledecker, 1981) assesses workload on three scales: (a) Time Load, (b) Mental Effort Load and, (c) Psychological Stress Load. Each scale has three possible rating levels: (a) low, (b) medium, and (c) high. The SWAT was administered in two phases. In the scale development phase, subjects rated the relative importance of the three scales in their perceptions of workload. To do this, the subjects rank ordered, from low to high, each of the 27 possible combinations of ratings on the three factors. A nonmetric conjoint analysis was applied to the ratings to create a table which was then used to convert the individual ratings into a single overall weighted rating. The conjoint analysis provided interval scale properties for the ratings, thus improving the reliability and validity of the ratings. The SWAT scales are presented in Appendix I.

There are two sources of evidence for the validity of the SWAT as a measure of workload. First, a comparison of the SWAT with another measure of subjective workload (National Aeronautics and Space Administration Bipolar Technique, Vidulich & Tsang, 1985) has shown that both measures provide similar results (Vidulich & Tsang, 1985).
Second, ratings on the SWAT appeared to vary as a function of experimentally-manipulated sources of workload (Eggemeier, McGhee, & Reid, 1983), and also varied as a function of individual differences in workload definition.

Subjects were asked to rate their workload on the three SWAT scales twice for each task, after seven and a half minutes of work, and at the end of fifteen minutes of work. The computer program prompted the subjects to make the ratings by displaying the scales on the monitor screen.

**Affective Responses to the Work**

**Personal Productivity**

A semantic differential measure of self-reported productivity, developed by Gardner (1986) was used in this study. The four scale items are presented in Appendix J.

**Task Satisfaction**

Job satisfaction is a multidimensional construct defined as the feelings a worker has about his job (Scott, 1967; Smith, Kendall, & Hulin, 1969; Loc.c, 1976; Cook, Hepworth, Wall, & Warr, 1981). Most approaches to the conceptualization and measurement of job satisfaction consider several facets of satisfaction—such as the work itself, the pay, the coworkers, the supervision, and the opportunities for promotion. These facets of satisfaction are usually combined to yield an estimate of overall job satisfaction. In the present study, measures of specific
satisfactions were selected to assess affective responses to (a) the work itself, and (b) to credit points that the subjects received in return for their participation. Other facets such as monetary pay were not considered because they did not apply in the present experiment.

**Morale Scales (Scott, 1967)**

Scott (1967) has defined "morale", or work satisfaction, as an internal emotional state arising from an individual's affective and cognitive reactions to different aspects of the work situation. Scott developed 299 bipolar, semantic differential scales for measuring nine concepts related to morale: (a) Me at Work; (b) My opportunities for Growth; (c) My Job; (d) My Supervisor; (e) Top Management, (f) Company Benefits; (g) My Fellow Workers; (h) My Pay; (i) My Working Conditions. Subjects rate the concepts on 7-point scales. Factor analyses of the scales measuring the "Me at Work" concept revealed a pattern of three principal dimensions. These dimensions are typically found in research using the semantic differential technique. They are: (a) evaluation, (b) arousal, and (c) potency. The evaluative dimension was also identified in the factor solutions for all the other concepts. The factor structures for the concepts have been replicated (Scott & Rowland, 1970), and the scales have been used to investigate responses to task characteristics (See Forbes & Barrett, 1978; Scott & Erskine, 1980; Farh & Scott, 1983).
In the present study, subjects completed a semantic differential scale for General Satisfaction set against the concept of ME AT THIS TASK, as well as a scale Task Complexity set against the concept of THIS TASK. For each concept, the scales were selected on the basis of high correlations with their respective factors, as presented in Scott and Erskine (1980). The scale items are presented in Appendix K.

Procedure

The study was conducted in two sessions. The first session lasted two hours and took place in a classroom. Groups of subjects completed the following: The demographic questionnaire, the Work Aspect Preference Scale, the Internal Control Index, the ability subscales of the Multidimensional Aptitude Battery (MAB), and the scale development phase of the Subjective Workload Assessment Technique. The subjects then chose a time for the simulated work session on the computer. These sessions were conducted in a microcomputer laboratory where several machines were available for use by psychology department students and faculty. The moderate noise levels generated by quiet conversations among the regular users of the facility and the sound of printers were deemed to add situational realism to the simulation. Two IBM PS2 model 50 computers with high-resolution colour monitors were used. Thus, two subjects in the same condition could be run during a work
session. The two computers were visually isolated from the others by a six-foot high folding wooden partition. The two computers were located side by side on separate desks, and were isolated from each other by moveable rolling wooden-framed cloth screens placed between the desks. On each desk three file folders were placed next to the computer. Each folder contained the instructions as well as the specific materials required for work on one of the three tasks. Also, sheets of paper containing material for input during the tutorial which preceded the work session were placed next to the keyboard. During the experimental sessions, the experimenter sat at a small desk between the screens and the two computers.

The subjects were greeted by the experimenter and asked to sit at one of the terminals. The experimenter then read the instructions (full text presented in Appendix I) to the subjects, following which the screens were moved into place and the subjects began a hands-on tutorial on how to use the keyboard and the computer. The tutorial, presented in Appendix M, assumed no previous experience with computers on the subject's part. The experimenter was available during this part to assist subjects at their request. When the subjects finished the tutorial, they rated their workload on it, following which they immediately began the experimental work session. During this part of the experiment, the subjects worked on the three tasks for a duration of 15 minutes each—with the subjects in the high JDL condition
being free to choose time allocation within the fifteen minute time alloted for each task. If subjects needed to read instructions for a task, they selected a screen display during which the computer was programmed to suspend timing of the task, and to record the duration of time spent reading instructions. While working on the tasks, the subjects also rated their workload twice on each of the three tasks. At the end of the work session, the experimenter asked the subjects to complete a questionnaire about their perceptions of the tasks and their affective responses to the work. The subjects were then given their credit point cards.

Data analysis procedures

Main Effects and Interactions of Task Characteristics

To test hypotheses listed from 1.1 to 1.3 about the main effects and the interactions of task complexity and job decision latitude (JDL), two-way split-plot factorial analyses of variance were performed on each of the dependent measures: (a) performance measures within each of the three tasks, (b) subjective workload ratings, and (c) perceptions of task characteristics and affective responses to the work. In all of the analyses noted above, overall F tests and planned comparisons were used to determine the significance of task effects.
Preferences for Task Characteristics

To test the hypothesis, listed as 2(a), that ability determines preferences for task complexity and new learning, correlations were tested between the Multidimensional Aptitude Battery subscale and keyboard skill test scores and the Work Aspect Preference Scale subscales of Self-Development and Creativity.

To test the hypothesis listed as 2(b) that personality determines preferences for job decision latitude, correlations were tested between the Internal Control Index and the WAPS scale of Independence. In addition, the overall pattern of correlations between ability measures, locus of control, and work preferences was examined.

Ability, Performance and Work Experience

According to Barrett's (1978) congruence theory, the match between ability and task demands is a major determinant of task satisfaction. To test hypothesis 3, the form of the relationship between ability and task satisfaction was examined separately within the low task complexity and the high task complexity conditions. This hypothesis was tested by assessing the form of the relationship between ability and task satisfaction. It was proposed that the form of the relationship would be linear when task complexity was low, and curvilinear when task complexity was high. Analyses of covariance were performed on the affective response measures with each of composite
MAB verbal and performance abilities as the covariate. Both linear and quadratic components of the ability composites were tested to determine the best fit to the data (Cohen & Cohen, 1983). According to congruence theory, there should be a strong negative linear relationship between ability and task satisfaction in the low task complexity conditions. In the high task complexity conditions, there should be an inverse U-shaped relationship between ability and task satisfaction, which should be manifested in a significant quadratic relationship.

**Personal Control Beliefs, Performance, and Work Experience**

Hypothesis four (a), which stated that personal control beliefs interact with task characteristics to determine task performance, was tested by analysis of covariance. There should be a significant interaction between task assignment and locus of control, after the effect of ability as a covariate has been controlled for statistically.

Finally, hypothesis four (b) which predicted differences in affective responses to task characteristics between internals and externals, was also tested by analysis of covariance, with ICI score as the covariate, on the measures of affective response to the tasks as the dependent variables.
Chapter III

RESULTS

The present study examined the interaction between selected task characteristics and individual differences variables in simulated computer-based clerical work. As noted earlier, the sample consisted of female subjects who worked on proofreading, text entry, and data entry tasks. The subjects worked in one of four task conditions varying in task characteristics of task complexity (TC), and job decision latitude (JDL). These conditions were as follows: (a) low task complexity and low job decision latitude; (b) high task complexity and low job decision latitude; (c) low task complexity and high job decision latitude; and (d) high task complexity and high job decision latitude.

Subjects' task-relevant abilities were measured by six subscales of the Multidimensional Aptitude Battery (MAB). Personality and attitudinal variables were measured by the Internal Control Index scale of locus of control and an enjoyment of computer item, and the thirteen subscales of the Work Aspect Preference Scale: (a) Independence; (b) Coworkers; (c) Self-Development; (d) Creativity; (e) Money; (f) Lifestyle; (g) Prestige; (h) Altruism; (i) Security; (j) Management; (k) Detachment; (l) Physical Activity; and (m) Surroundings.

These four task condition groups were compared in terms of the following dependent variables: (a) quantity and
quality of task performance; (b) subjective workload ratings; and, (c) perceptions of the tasks and affective responses to the work. Quantity and quality of task performance were measured by the number of task units accomplished and the number of errors, respectively. The Subjective Workload Assessment Technique (SWAT) was used to assess three dimensions of workload: (a) Time Load; (b) Mental Effort Load, and; (c) Psychological Stress Load. Subjects rated their subjective workload on two occasions for each of the three experimental tasks. Subjects also rated their perceptions of the tasks and their affective responses to the work on the following scales: (a) task satisfaction; (b) task complexity; (c) intrinsic satisfaction; (d) task uncertainty; (e) pace; (f) variety; (g) challenge; (h) freedom; (i) meaningfulness; (j) responsibility; (k) perceived productivity; and (l) skill-utilization.

**Principal Components Analysis of Perceptions of Task Characteristics and Affective Responses to Work**

There is some overlap in the item content and some similarity among the constructs of the twelve scales which measure task perceptions and affective responses to the work. The intercorrelations among the scales measuring perceptual and affective responses to the work are presented in Table 6. These twelve scales were subjected to a principal components factor analysis in order to identify a
Table 6

Intercorrelations between Perceptual and Affective Response Scales

<table>
<thead>
<tr>
<th>Variable</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>7</th>
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<td>.25**</td>
<td>.04</td>
<td>.15</td>
<td>.00</td>
<td>-.23**</td>
<td>.20**</td>
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<tr>
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<td>.41***</td>
<td>.00</td>
<td>.50***</td>
<td>.43***</td>
<td>.16</td>
<td>.19*</td>
<td>.06</td>
<td>-.27**</td>
<td>.48***</td>
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<td>-.03</td>
<td>.37***</td>
<td>.49***</td>
<td>.00</td>
<td>.09</td>
<td>.07</td>
<td>-.30</td>
<td>.51***</td>
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<tr>
<td>UNGER</td>
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<td>.46***</td>
<td>.54***</td>
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<td>.02**</td>
<td>.02</td>
<td>-.12</td>
<td>-.30**</td>
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<td>-.04</td>
<td>.46***</td>
<td>.12</td>
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<td>-.12</td>
<td>-.30**</td>
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<td>-.27</td>
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<td>CHALLEN</td>
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<td>.14</td>
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<td>FREEDON</td>
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<td>.15</td>
<td>-.08</td>
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<td></td>
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</tr>
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<td>MEANING</td>
<td>--</td>
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<td>.23**</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>RESPONS</td>
<td>--</td>
<td>-.24**</td>
<td>.16</td>
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<tr>
<td>PERCPROD</td>
<td>--</td>
<td>-.30**</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

*p < .05    **p < .02    ***p < .001

NOTE: TASKATT: Task Attractiveness
TASKCOMP: Task Complexity
INSAT: Intrinsic Task Satisfaction
UNCER: Uncertainty
PACE: Pace
VARIETY: Variety

CHALLEN: Challenge
FREEDOM: Freedom
MEANING: Meaningfulness
RESPONS: Responsibility
PERCPROD: Perceived Productivity
SKILLUT: Skill Utilization
smaller set of factors for use as the dependent variables in subsequent analyses. With the use of the Statistical Analysis System (SAS) PROC FACTOR subroutine, two reliable principal components were extracted and retained on the basis of Cattell's scree test and the following criteria: Eigenvalues greater than one, and having two or more substantial variable loadings ($r > .40$) on each factor. To interpret the substantive nature of the factors, a varimax rotation was also performed. Orthogonal rotation was retained because of conceptual simplicity and ease of description. The factor loadings, communalities, percents of variance and covariance accounted for are shown in Table 7. A plot of the rotated factor solution is presented in Figure 6. With a loading cut of .40 for including a variable in the interpretation of a factor, two of the twelve variables, Perceived Productivity and Responsibility, were not interpreted. The remaining variables exhibited adequate simple structure. The three variables with low loadings on the first factor had the highest loadings on the second; and, for a loading cut of .40, no variable loads on more than one factor.

Inspection of the pattern of variable loadings on the first factor, in Figure 6, shows high loadings for scales tapping perceptions of skill utilization, task meaningfulness, task complexity, and task uncertainty. This suggests that perceptions of task complexity and attitudinal responses to task complexity were closely related and not
Table 7
Loadings, Communalities, Sums of Squared Loadings (SSIs),
Variance and Covariance of Orthogonally Rotated Affective
Response Factors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Communalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Satisfaction</td>
<td>.46</td>
<td>.03</td>
<td>.217</td>
</tr>
<tr>
<td>Task Complexity</td>
<td>.73</td>
<td>.08</td>
<td>.542</td>
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<tr>
<td>Intrinsic Satisfaction</td>
<td>.72</td>
<td>-.01</td>
<td>.520</td>
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<tr>
<td>Uncertainty</td>
<td>.67</td>
<td>-.17</td>
<td>.480</td>
</tr>
<tr>
<td>Pace</td>
<td>-.13</td>
<td>.81</td>
<td>.674</td>
</tr>
<tr>
<td>Variety</td>
<td>.70</td>
<td>.22</td>
<td>.548</td>
</tr>
<tr>
<td>Challenge</td>
<td>.81</td>
<td>.06</td>
<td>.675</td>
</tr>
<tr>
<td>Freedom</td>
<td>.10</td>
<td>.78</td>
<td>.620</td>
</tr>
<tr>
<td>Meaningfulness</td>
<td>.67</td>
<td>.31</td>
<td>.561</td>
</tr>
<tr>
<td>Responsibility</td>
<td>.11</td>
<td>.43</td>
<td>.201</td>
</tr>
<tr>
<td>Perceived Productivity</td>
<td>.39</td>
<td>-.31</td>
<td>.254</td>
</tr>
<tr>
<td>Skill-Utilization</td>
<td>.78</td>
<td>.14</td>
<td>.631</td>
</tr>
</tbody>
</table>

SSIs: 4.160 1.769 5.929

Proportion of Variance: .34 .14 .49

Proportion of Covariance: .70 .29
**Figure 6:** Plot of factor pattern for factor one (1) and factor two (2).

**NOTE**
A = Task Satisfaction.
B = Task Complexity.
C = Intrinsic Satisfaction.
D = Uncertainty.
E = Pace.
F = Variety.
G = Challenge.
H = Freedom.
I = Meaningfulness.
J = Responsibility.
K = Perceived Productivity.
L = Skill-Utilization.
very clearly differentiated. People who saw the tasks as complex and varied also felt them to be more challenging, meaningful and intrinsically satisfying. An appropriate label for Factor One was that of Perceived Task Complexity.

In the pattern of variable loadings on the second factor, the three scales with high loadings -- pace control, freedom, and responsibility-- all addressed different aspects of decision making and discretion in the work. Accordingly, Factor Two was labelled Perceived Job Decision Latitude. Subjects who scored high on this dimension saw the experimental tasks as providing them with considerable freedom in decision making and they experienced a sense of responsibility for their work.

Factor scores for each subject were computed using the variable weights from the rotated solution. These factor scores were then used subsequently for all analyses of hypotheses involving task perceptions and affective responses to work.

**Task Characteristics**

Hypothesis one examined the effects of task complexity and decision latitude on the following three testable parts: (1.1) performance; (1.2) subjective workload, and; (1.3) task perceptions and affective responses to the work. To test hypothesis one, a two-factor split-plot analysis of variance (ANOVA) was performed on each of the performance, workload, and affective response dependent variables. The
independent variables in all these analyses were the experimental manipulations of job decision latitude (JDL), and time allocation (TA) nested within task complexity.

Performance: Hypothesis 1.1

Hypothesis 1.1 was a differential test of competing predictions: The job enrichment (JE) approach to job design predicted that performance will be the highest in the high task complexity (HTC) and high job decision latitude (HJDL) condition; while, the job simplification (JS) approach to job design predicted that performance will be highest in the low task complexity (LTC) and low job decision latitude (LJDL) condition.

To test hypothesis 1.1, ANOVAs were conducted on four of the six task performance measures. These four dependent variables were: (1) proofreading task quantity (PRQUAN); (2) proofreading task quality (PRQUAL); (3) data entry task quantity (DEQUAN), and; (4) data entry task quality (DEQUAL). Two dependent variables (test entry quantity and test entry quality) were omitted from the analysis due to a program statement error which resulted in some missing observations in these two measures. The results from the analyses on each of the four performance variables failed to support the prediction made by the job enrichment (JE) approach; however, the prediction made by the job simplification (JS) approach was supported.
1. **Proofreading Task Quantity (PROQUAN)**

   **MAIN EFFECT FOR TASK COMPLEXITY (TC): SIGNIFICANT.**

   On the proofreading task, quantity of performance was significantly affected by task complexity (TC), $F(1, 63) = 8.90, p < .004$.

   **MAIN EFFECT FOR JOB DECISION LATITUDE (JDL): NOT SIGNIFICANT.**

   **INTERACTION EFFECT: NOT SIGNIFICANT.**

   There was no significant main effect of job decision latitude (JDL), nor was there a significant effect for the interaction of TC and JDL. The ANOVA summary table for this analysis is presented in Table 8, and the main effect and cell means are presented in Table 9. Inspection of the means for the low and high TC conditions shows that the number of lines proofread was higher in the Low TC condition ($\bar{x} = 154.10$) than in the High TC condition ($\bar{x} = 117.94$).

2. **Proofreading Task Quality (PROQUAL)**

   **MAIN EFFECT FOR TC: SIGNIFICANT.**

   The analysis of variance (ANOVA) on the quality of proofreading task performance revealed results similar to those for performance quantity. Task complexity significantly affected performance quality, $F(1, 63) = 26.24, p < .0001$.

   **MAIN EFFECT FOR JDL: NOT SIGNIFICANT.**

   **INTERACTION EFFECT: NOT SIGNIFICANT.**

   Neither the JDL main effect nor the interaction of TC with JDL were statistically significant. A summary table
Table 8

Analysis of Variance on Proofreading Quantity

(PRQUAN) Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN BLOCKS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC</td>
<td>1</td>
<td>56139.74</td>
<td>56139.74</td>
<td>8.90</td>
<td>.0065**</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>63</td>
<td>397529.94</td>
<td>6309.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITHIN BLOCKS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1</td>
<td>2062.20</td>
<td>2062.20</td>
<td>0.30</td>
<td>.5883</td>
</tr>
<tr>
<td>TC X JDL</td>
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<td>6958.36</td>
<td>6958.36</td>
<td>1.00</td>
<td>.3217</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>50</td>
<td>34312.96</td>
<td>6946.25</td>
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<td></td>
</tr>
</tbody>
</table>

Note. TC : Task Complexity
TA(TC): Time Allocation, blocked under Task Complexity
JDL : Job Decision Latitude

** P < .01
Table 9

**Main Effects and Cell Means for Proofreading Quantity (PROUAN) Scores**

<table>
<thead>
<tr>
<th>Task Complexity</th>
<th>Job decision latitude</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>n 29</td>
<td>n 30</td>
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<tr>
<td></td>
<td>M 152.58</td>
<td>M 155.56</td>
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<tr>
<td></td>
<td>SD 51.74</td>
<td>SD 68.69</td>
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<tr>
<td>High</td>
<td>n 26</td>
<td>n 32</td>
</tr>
<tr>
<td></td>
<td>M 111.69</td>
<td>M 123.03</td>
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<tr>
<td></td>
<td>SD 43.43</td>
<td>SD 125.19</td>
</tr>
<tr>
<td>Total</td>
<td>n 55</td>
<td>n 62</td>
</tr>
<tr>
<td></td>
<td>M 133.25</td>
<td>M 138.77</td>
</tr>
<tr>
<td></td>
<td>SD 51.82</td>
<td>SD 102.35</td>
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</tbody>
</table>
for this analysis is presented in Table 10. The main effect and cell means are presented in Table 11. Subjects made fewer errors ($\bar{X} = 75.47$) in the Low TC condition than in the high TC condition ($\bar{X} = 57.65$).

**Data Entry Task Quantity (DEQUAN)**

**MAIN EFFECT FOR TC: SIGNIFICANT.**

**MAIN EFFECT FOR JDL: SIGNIFICANT.**

**INTERACTION: SIGNIFICANT.**

The ANOVA for task characteristics on performance quantity (DEQUAN) in the data entry task yielded statistically significant main effects for both task complexity (TC) and job decision latitude (JDL), as well as a significant effect for the interaction of TC and JDL. A summary table is presented in Table 12, and main effect and cell means are presented in Table 13. Subjects in the Low TC condition made significantly more entries than subjects in the High TC condition ($\bar{X} = 26.66$, and $\bar{X} = 15.86$, respectively), $F(1, 63) = 15.03$, $p < .0001$. Subjects also made significantly more entries under Low JDL conditions than under High JDL conditions ($\bar{X} = 24.32$, and $\bar{X} = 18.42$), $F(1, 63) = 8.77$, $p < .005$. The interaction effect between TC and JDL was also significant, $F(1, 63) = 7.27$, $p < .01$. A plot of the cell means, shown in Figure 7, shows that task complexity (TC) and job decision latitude (JDL) interact. The nature of the interaction is such that LJDL greatly increased the number of data entries made while HJDL
Table 10

Analysis of Variance on Proofreading Quality (PRQUAL) Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
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<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN BLOCKS</td>
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<td></td>
</tr>
<tr>
<td>TC</td>
<td>1</td>
<td>8066.36</td>
<td>8066.36</td>
<td>26.24</td>
<td>.0001**</td>
</tr>
<tr>
<td>TA(TC)</td>
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<td>19370.12</td>
<td>307.40</td>
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<td>WITHIN BLOCKS</td>
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</tr>
<tr>
<td>JDL</td>
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<td>371.56</td>
<td>1.09</td>
<td>.3010</td>
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<td>46.20</td>
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<td>.7140</td>
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<td>340.12</td>
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</table>

Note. TC : Task Complexity
TA(TC): Time Allocation, blocked under Task Complexity
JDL : Job Decision Latitude

** p < .01
Table 11

Main Effect and Cell Means for Proofreading Quality

(Proqual) Scores

<table>
<thead>
<tr>
<th>Task Complexity</th>
<th>Job Decision Latitude</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
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<td>n 30</td>
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<tr>
<td>M</td>
<td>76.55</td>
<td>74.43</td>
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<td>SD</td>
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<td>High</td>
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<td>n 32</td>
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<tr>
<td>M</td>
<td>61.26</td>
<td>54.71</td>
</tr>
<tr>
<td>SD</td>
<td>17.12</td>
<td>22.49</td>
</tr>
<tr>
<td>Total</td>
<td>n 55</td>
<td>n 62</td>
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<tr>
<td>M</td>
<td>69.32</td>
<td>64.25</td>
</tr>
<tr>
<td>SD</td>
<td>15.88</td>
<td>22.89</td>
</tr>
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</table>
Table 12

Analysis of Variance on Data Entry Quantity (DEQUAN) Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
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<tbody>
<tr>
<td>BETWEEN BLOCKS</td>
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<td>TC</td>
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<td>4167.73</td>
<td>4167.73</td>
<td>15.03</td>
<td>.0002**</td>
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<td>TA(TC)</td>
<td>65</td>
<td>18023.96</td>
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<td>WITHIN BLOCKS</td>
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<tr>
<td>JDL</td>
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</tr>
</tbody>
</table>

Note. TC : Task Complexity
TA(TC) : Time Allocation, blocked under Task Complexity
JDL : Job Decision Latitude

* p < .05. ** p < .01.
Table 13

Main Effect and Cell Means for Data Entry Quantity (DEQUAN) Scores

<table>
<thead>
<tr>
<th>Task Complexity</th>
<th>Job Decision Latitude</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>n 20</td>
<td>n 31</td>
</tr>
<tr>
<td></td>
<td>m 33.90</td>
<td>m 22.00</td>
</tr>
<tr>
<td></td>
<td>SD 10.45</td>
<td>SD 18.80</td>
</tr>
<tr>
<td>High</td>
<td>n 26</td>
<td>n 32</td>
</tr>
<tr>
<td></td>
<td>m 16.96</td>
<td>m 14.96</td>
</tr>
<tr>
<td></td>
<td>SD 17.20</td>
<td>SD 22.49</td>
</tr>
<tr>
<td>Total</td>
<td>n 46</td>
<td>n 63</td>
</tr>
<tr>
<td></td>
<td>m 24.32</td>
<td>m 18.42</td>
</tr>
<tr>
<td></td>
<td>SD 13.04</td>
<td>SD 18.05</td>
</tr>
</tbody>
</table>
Figure 7: The interaction effects of job decision latitude and task complexity on quantity of data entry task performance.
minimally increased the number of data entries made in the Low TC condition relative to the high TC condition.

4. Data Entry Task Quality (DEQUAL)

MAIN EFFECT FOR TC: NOT SIGNIFICANT.

MAIN EFFECT FOR JDL: SIGNIFICANT.

INTERACTION: SIGNIFICANT.

Turning to the quality of performance on the data entry task, the analysis of variance, summarized in Table 14, shows a statistically significant main effect for JDL and a significant interaction between TC and JDL, but not for the TC main effect. Table 15 indicates that subjects in the High JDL condition made fewer correct entries ($\bar{X} = 7.09$) than subjects in the Low JDL condition ($\bar{X} = 10.70$, $F(1, 65) = -12.82, p < .0008$). As for the interaction of TC and JDL, a plot of the cell means is presented in Figure 8, and suggests that when task complexity is low, low JDL increased performance, while high JDL reduced performance. The nature of the interaction is such that the LJDL greatly increased the number of correct entries made ($\bar{X} = 12.10$) while HJDL minimally decreased the number of correct entries ($\bar{X} = 16.35$) made in the low TC condition relative to the high TC condition.

The overall pattern of findings from the analyses of the performance data to test hypothesis one (1.1) was clear and unequivocal. Both output (quantity) and quality were higher when tasks were low in complexity. Furthermore, the
Table 14

**Analysis of Variance on Data Entry Quality (DEQUAL) Scores**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BETWEEN BLOCKS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC</td>
<td>1</td>
<td>14.04</td>
<td>14.04</td>
<td>0.52</td>
<td>.4755</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>65</td>
<td>1771.83</td>
<td>27.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>WITHIN BLOCKS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1</td>
<td>251.34</td>
<td>251.34</td>
<td>12.82</td>
<td>.0008**</td>
</tr>
<tr>
<td>TC X JDL</td>
<td>1</td>
<td>123.28</td>
<td>123.28</td>
<td>6.</td>
<td>.0156*</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>48</td>
<td>940.85</td>
<td>19.60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note.** TC : Task Complexity  
TA(TC) : Time Allocation, blocked under Task Complexity  
JDL : Job Decision Latitude

* p < .05.  ** p < .01.
Table 15

Main Effect and Cell Means for Data Entry Quality
(DEQUAL) Scores

<table>
<thead>
<tr>
<th>Task Complexity</th>
<th>Job Decision Latitude</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>n 28</td>
<td>n 31</td>
</tr>
<tr>
<td></td>
<td>M 12.10</td>
<td>M 6.35</td>
</tr>
<tr>
<td></td>
<td>SD 3.70</td>
<td>SD 6.17</td>
</tr>
<tr>
<td>High</td>
<td>n 26</td>
<td>n 32</td>
</tr>
<tr>
<td></td>
<td>M 9.19</td>
<td>M 7.81</td>
</tr>
<tr>
<td></td>
<td>SD 4.58</td>
<td>SD 4.65</td>
</tr>
<tr>
<td>Total</td>
<td>n 54</td>
<td>n 63</td>
</tr>
<tr>
<td></td>
<td>M 10.70</td>
<td>M 7.09</td>
</tr>
<tr>
<td></td>
<td>SD 4.36</td>
<td>SD 5.46</td>
</tr>
</tbody>
</table>
Figure 8: The interactive effects of job decision latitude and task complexity on quality of data entry task performance.
interaction of task complexity and job decision latitude was such that the highest quantity and quality of performance were attained when tasks were low in both complexity and job decision latitude. As hypothesized, these results supported the predictions made by the proponents of job simplification about work performance.

Workload: Hypothesis 1.2

Hypothesis 1.2 consisted of two testable parts. The first part (Hypothesis 1.2a) predicted that subjective workload would be higher in the high task complexity condition than in the low task complexity condition. The second part predicted that high job decision latitude would result in lower subjective workload than low job decision latitude. The analysis of the Subjective Workload Assessment Technique (SWAT) scale data proceeded in two steps, each of which is described in the two sections that follow.

Scale Development Phase

Prior to the experiment subjects were asked to rank order each of the 27 possible combinations of 3-point ratings of time load, mental effort load, and psychological stress load on the SWAT (see p. 104). On the basis of their rank ordering of combinations of workload ratings, the subjects were assigned to homogeneous prototype groups. Prototypes represent 'ideal' and internally consistent ways of rating workload according to the relative importance of
time load, mental effort load, and psychological stress load. There are 6 prototypes, one for each of the six possible orders of time load, mental effort load, and psychological stress load. Using the SWAT software package, Kendall's coefficients of concordance were calculated between each subject's rank order and each of the six possible prototype orders. Each subject was assigned to the prototype group with which her rank order showed the highest coefficient of concordance. Thus, 5 groups of subjects were formed. There were not enough subjects in the mental effort prototype group to divide them into the two possible subgroups (time load or psychological stress load as second most important factor), so only one prototype group was formed. The resultant 5 prototype groupings were satisfactorily homogeneous in rank order representation as evidenced by an overall coefficient of concordance which met or exceeded the criterion minimum of .80 for all five groups.

Using conjoint analysis, interval level scale weights were calculated for each combination of ratings on the three workload factors for each of the six prototype groups. Thus, for each of the 5 prototype groups, these weights were used to convert each combination of three-point ratings on the three factors--time load, mental effort load, and psychological stress load--into a single number on an interval-level scale ranging from 0 (lowest workload) to 100
Analysis of Event Scoring Phase Data

During the experiment, the subjects rated their workload on each of the three tasks twice: at the midpoint (7'30''), and at the end (15') of the period of time allotted for the task. To test the hypothesis that workload varies as function of task complexity and JDL, a repeated-measures split-plot factorial analysis of variance was performed on each pair of weighted workload ratings for each of the three tasks. The results of the analyses of variance for proofreading, text entry, and data entry are displayed in Tables 16, 17, and 18 respectively. There were no significant effects due to task characteristics. Overall, subjects reported the same levels of workload in all conditions. However, variations in workload levels were apparent over time. On the proofreading task, the level of reported workload decreased significantly over time, $F(1, 53) = 7.65, p < .007$. On the text entry task, there was a significant interaction of time and JDL, $F(1, 53) = 4.90, p < .03$. The nature of this interaction is such that workload increased over time for subjects in the low JDL condition ($\bar{X}$ at Time 1 = 47.8, $\bar{X}$ Time at 2 = 50.8), while workload decreased over time for subjects in the high JDL condition ($\bar{X}$ at Time 1 = 55.2, $\bar{X}$ at Time 2 = 49.8). In a similar fashion on the data entry task, there was an interaction between time and JDL $F(1, 46) = 4.73, p < .034$. Here again,
Table 16

Analysis of Variance on SWAT ratings for Proofreading Task

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>1</td>
<td>985.37</td>
<td>985.37</td>
<td>0.71</td>
<td>.40</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>66</td>
<td>123691.46</td>
<td>1874.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1</td>
<td>254.68</td>
<td>254.68</td>
<td>0.18</td>
<td>.66</td>
</tr>
<tr>
<td>TC X JDL</td>
<td>1</td>
<td>66.67</td>
<td>66.67</td>
<td>0.05</td>
<td>.82</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>53</td>
<td>73077.28</td>
<td>1378.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>1</td>
<td>1246.58</td>
<td>1246.58</td>
<td>7.65</td>
<td>.00**</td>
</tr>
<tr>
<td>TIME*TC</td>
<td>1</td>
<td>48.54</td>
<td>48.54</td>
<td>0.19</td>
<td>.66</td>
</tr>
<tr>
<td>TIME*TA(TC)</td>
<td>66</td>
<td>17237.55</td>
<td>261.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME*JDL</td>
<td>1</td>
<td>143.03</td>
<td>143.03</td>
<td>0.88</td>
<td>.35</td>
</tr>
<tr>
<td>TIME<em>TC</em>JDL</td>
<td>1</td>
<td>68.00</td>
<td>68.00</td>
<td>0.42</td>
<td>.52</td>
</tr>
<tr>
<td>ERROR(TIME)</td>
<td>53</td>
<td>8636.16</td>
<td>162.94</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. TC : Task Complexity  
TA(TC): Time Allocation, blocked under Task Complexity  
JDL : Job Decision Latitude

* p < .01.
Table 17

Analysis of Variance on SWAT ratings for Text Entry Task

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>1</td>
<td>985.37</td>
<td>985.37</td>
<td>0.71</td>
<td>.40</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>66</td>
<td>123691.46</td>
<td>1874.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1</td>
<td>2087.25</td>
<td>2087.25</td>
<td>1.65</td>
<td>.20</td>
</tr>
<tr>
<td>TC X JDL</td>
<td>1</td>
<td>1184.81</td>
<td>1184.81</td>
<td>0.93</td>
<td>.33</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>50</td>
<td>67233.30</td>
<td>1268.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>1</td>
<td>29.42</td>
<td>29.42</td>
<td>0.16</td>
<td>.69</td>
</tr>
<tr>
<td>TIME*TC</td>
<td>1</td>
<td>220.07</td>
<td>220.07</td>
<td>0.86</td>
<td>.35</td>
</tr>
<tr>
<td>TIME*TA(TC)</td>
<td>65</td>
<td>16652.15</td>
<td>256.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME*JDL</td>
<td>1</td>
<td>907.12</td>
<td>907.12</td>
<td>4.90</td>
<td>.03*</td>
</tr>
<tr>
<td>TIME<em>TC</em>JDL</td>
<td>1</td>
<td>0.51</td>
<td>0.51</td>
<td>0.00</td>
<td>.95</td>
</tr>
<tr>
<td>ERROR(TIME)</td>
<td>53</td>
<td>9809.83</td>
<td>185.51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. TC : Task Complexity
        TA(TC): Time Allocation, blocked under Task Complexity
        JDL : Job Decision Latitude

* p < .05.
Table 18

Analysis of Variance on SWAT ratings for Data Entry Task

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td>1</td>
<td>426.73</td>
<td>426.73</td>
<td>0.30</td>
<td>.58</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>65</td>
<td>91749.66</td>
<td>1411.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1</td>
<td>167.71</td>
<td>167.11</td>
<td>0.09</td>
<td>.76</td>
</tr>
<tr>
<td>TC X JDL</td>
<td>1</td>
<td>3544.28</td>
<td>3544.28</td>
<td>1.92</td>
<td>.17</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>46</td>
<td>84902.10</td>
<td>1845.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>1</td>
<td>78.55</td>
<td>78.55</td>
<td>0.58</td>
<td>.45</td>
</tr>
<tr>
<td>TIME*TC</td>
<td>1</td>
<td>27.73</td>
<td>27.73</td>
<td>0.17</td>
<td>.68</td>
</tr>
<tr>
<td>TIME*TA(TC)</td>
<td>65</td>
<td>10596.99</td>
<td>163.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME*JDL</td>
<td>1</td>
<td>644.62</td>
<td>644.62</td>
<td>4.73</td>
<td>.03*</td>
</tr>
<tr>
<td>TIME<em>TC</em>JDL</td>
<td>1</td>
<td>266.57</td>
<td>266.57</td>
<td>1.96</td>
<td>.17</td>
</tr>
<tr>
<td>ERROR(TIME)</td>
<td>46</td>
<td>6262.57</td>
<td>136.1</td>
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<td></td>
</tr>
</tbody>
</table>

Note. TC : Task Complexity  
TA(TC): Time Allocation, blocked under Task Complexity  
JDL : Job Decision Latitude  

* p < .05.
subjects in the high JDL condition reported a decrease in workload over time ($\bar{X}$ at Time 1 = 53.1, $\bar{X}$ at Time 2 = 48.4), while the subjects in the low JDL condition reported about the same level of workload at both points in time ($\bar{X}$ at Time 1 = 55.9, $\bar{X}$ at Time 2 = 56.3). The changes in workload ratings over time on the text entry task and the data entry task were consistent with the hypothesis that high JDL allows people more opportunities to regulate their responses to the demands imposed on them by the work, thereby reducing workload.

**Task Perceptions and Affective Responses to Work: Hypothesis 1.3**

Affective responses to work were predicted to be more positive in high complexity and high decision latitude task conditions than in low complexity and low decision latitude conditions, respectively. The combination of high task complexity and high JDL were predicted to result in the most positive affective responses to the work. Conversely, low JDL and low TC were predicted to result in the highest level of performance, but the least positive affective responses to the work. The measures used to test this hypothesis were the scores for the two (2) factors identified in the principal components factor analysis of the task perceptions and affective responses to work subscales.
Two Factors Used in the Analysis

1. FACTOR ONE: Perceptions of Task Complexity

   MAIN EFFECT FOR TC: NOT SIGNIFICANT.
   MAIN EFFECT FOR JDL: SIGNIFICANT.
   INTERACTION: NOT SIGNIFICANT.

   There was no main effect for task complexity, nor was there a significant interaction between task complexity and job decision latitude. An analysis of variance summary table appears in Table 19. The standardized factor score means are reported in Table 20. An examination of the standardized factor score means for perceived task complexity leads to the unexpected conclusion that perceived task complexity was significantly lower ($\bar{X} = -0.16$) in the High JDL condition than in the Low JDL condition ($\bar{X} = 0.17$). In the analysis of variance (ANOVA) on the perceptions of task complexity, a significant main effect was found for job decision latitude, $F(1, 67) = 4.27, p < .04$.

2. FACTOR TWO: Perceptions of Job Decision Latitude

   MAIN EFFECT FOR TC: NOT SIGNIFICANT.
   MAIN EFFECT FOR JDL: SIGNIFICANT.
   INTERACTION EFFECT: NOT SIGNIFICANT.

   Table 21 presents the analysis of variance on perceptions of job decision latitude. The JDL manipulation had a statistically significant main effect, $F(1, 67) = 5.17, p < .026$. An examination of the mean standardized factor scores for perceived job decision latitude,
Table 19

Analysis of Variance on Perceived Task Complexity

Factor Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BETWEEN BLOCKS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC</td>
<td>1</td>
<td>1.48</td>
<td>1.48</td>
<td>1.44</td>
<td>.2347</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>67</td>
<td>69.06</td>
<td>1.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITHIN BLOCKS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1</td>
<td>3.81</td>
<td>3.81</td>
<td>4.27</td>
<td>.0428*</td>
</tr>
<tr>
<td>TC X JDL</td>
<td>1</td>
<td>0.73</td>
<td>0.73</td>
<td>0.82</td>
<td>.3684</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>63</td>
<td>56.27</td>
<td>0.89</td>
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<td></td>
</tr>
</tbody>
</table>

Note. TC : Task Complexity
TA(TC): Time Allocation, blocked under Task Complexity
JDL : Job Decision Latitude
* p < .05.
Table 20

Main Effects and Cell Means for Perceived Task Complexity Factor Scores

<table>
<thead>
<tr>
<th>Task Complexity</th>
<th>Job Decision Latitude</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>n 33</td>
<td>n 34</td>
</tr>
<tr>
<td>M</td>
<td>0.34</td>
<td>-0.04</td>
</tr>
<tr>
<td>SD</td>
<td>0.83</td>
<td>1.05</td>
</tr>
<tr>
<td>High</td>
<td>n 33</td>
<td>n 34</td>
</tr>
<tr>
<td>M</td>
<td>-0.11</td>
<td>-0.17</td>
</tr>
<tr>
<td>SD</td>
<td>0.94</td>
<td>1.10</td>
</tr>
<tr>
<td>Total</td>
<td>n 66</td>
<td>n 68</td>
</tr>
<tr>
<td>M</td>
<td>0.17</td>
<td>-0.16</td>
</tr>
<tr>
<td>SD</td>
<td>0.91</td>
<td>1.07</td>
</tr>
</tbody>
</table>
Table 21

Analysis of Variance on Perceived Job Decision

Latitude Factor Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETWEEN BLOCKS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC</td>
<td>1</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
<td>.8228</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>67</td>
<td>70.63</td>
<td>1.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITHIN BLOCKS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1</td>
<td>4.51</td>
<td>4.51</td>
<td>5.17</td>
<td>.0263*</td>
</tr>
<tr>
<td>TC X JDL</td>
<td>1</td>
<td>0.68</td>
<td>0.68</td>
<td>0.78</td>
<td>.3791</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>63</td>
<td>54.33</td>
<td>0.87</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. TC : Task Complexity
TA(TC): Time Allocation, blocked under Task Complexity
JDL : Job Decision Latitude

* p < .05
reported in Table 22, showed that, as predicted, subjects in the high JDL condition perceived significantly greater JDL (\( \bar{x} = .21 \)) than subjects in the low JDL condition (\( \bar{x} = -.22 \)). These analyses provided some support for the predictions made by the job enrichment approach about task perceptions and the affective responses to the work. As predicted, subjects in the high JDL condition perceived having greater JDL than subjects in the low JDL condition. The task complexity manipulation did not have an effect on perceptions of task complexity. However, subjects perceived less task complexity in the high JDL condition than in the low JDL condition. This finding is consistent with the job enrichment prediction that high JDL can offset the deleterious consequences of high task complexity (e.g., Karasek, 1979); although, a significant interaction would make a stronger demonstration of this effect.

**Individual Differences and Preferences for Task Characteristics: Hypothesis 2**

The second hypothesis was a test of predictions made by congruence theory about the relationship between individual differences in abilities and in personality traits, and preferences for task characteristics.

The congruence model states that abilities are related to preferences for task complexity, variety, and for learning new skills; and, that personality and attitude variables are related to preferences for job decision latitude. Specifically, congruence theory as articulated by
Table 22

Main Effects and Cell Means for Perceived Job Decision Latitude Scores

<table>
<thead>
<tr>
<th>Task Complexity</th>
<th>Job Decision Latitude</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>n 33</td>
<td>n 34</td>
</tr>
<tr>
<td></td>
<td>M -0.31</td>
<td>M 0.34</td>
</tr>
<tr>
<td></td>
<td>SD 0.90</td>
<td>SD 0.98</td>
</tr>
<tr>
<td>High</td>
<td>n 33</td>
<td>n 34</td>
</tr>
<tr>
<td></td>
<td>M -0.20</td>
<td>M 0.15</td>
</tr>
<tr>
<td></td>
<td>SD 0.94</td>
<td>SD 1.05</td>
</tr>
<tr>
<td>Total</td>
<td>n 66</td>
<td>n 68</td>
</tr>
<tr>
<td></td>
<td>M -0.22</td>
<td>M 0.21</td>
</tr>
<tr>
<td></td>
<td>SD 0.91</td>
<td>SD 1.01</td>
</tr>
</tbody>
</table>
Barrett (1978), states that abilities are related to preferences for task characteristics while personality traits and attitudes are related to preferences for autonomy, i.e., job decision latitude. This prediction was assessed by examining the correlations among the Multidimensional Aptitude Battery (MAB) subscales, the Keyboard Skill Test score, the Internal Control Index (ICI), and the subscales of the Work Aspect preference Scales (WAPS), which are presented in Table 23. Subjects' scores on the Self-Development scale of the WAPS were used as an index of the importance they placed on skill-utilization, which was an important aspect of perceived task complexity. Scores on the Independence and Creativity scales of the WAPS were used as indices of the importance that subjects placed on job decision latitude. Among the ability measures, the MAB Arithmetic Scale had a significant negative correlation with WAPS Security Scale ($r = -.17, p < .04$), and the MAB Vocabulary Scale was positively correlated with WAPS Independence Scale ($r = .24, p < .04$). Keyboard skill level was negatively correlated with WAPS Self-Development ($r = -.19, p < .03$). Only this latter correlation was consistent with the congruence theory prediction that ability was related to preference for task complexity. However, the negative sign of the correlation leads to an interpretation that is at odds with congruence theory: The higher the level of typing ability, the less importance people place on self-development. Furthermore, the positive association of
Table 23
Correlations of Work Aspect Preferences with Ability Measures and Locus of Control

<table>
<thead>
<tr>
<th>Variable</th>
<th>COMP</th>
<th>ARIT</th>
<th>VOCA</th>
<th>DISP</th>
<th>PICO</th>
<th>SPAT</th>
<th>ICI</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDEP</td>
<td>.15</td>
<td>.00</td>
<td>.24**</td>
<td>-.07</td>
<td>-.04</td>
<td>-.16</td>
<td>.06</td>
</tr>
<tr>
<td>COWORK</td>
<td>.01</td>
<td>-.04</td>
<td>.01</td>
<td>.01</td>
<td>-.05</td>
<td>.02</td>
<td>-.03</td>
</tr>
<tr>
<td>SELFDEV</td>
<td>.01</td>
<td>-.08</td>
<td>.13</td>
<td>-.06</td>
<td>-.06</td>
<td>-.02</td>
<td>.38***</td>
</tr>
<tr>
<td>CREATI</td>
<td>.04</td>
<td>-.02</td>
<td>.07</td>
<td>.02</td>
<td>-.01</td>
<td>-.08</td>
<td>.27***</td>
</tr>
<tr>
<td>MONEY</td>
<td>-.09</td>
<td>-.15</td>
<td>-.01</td>
<td>-.05</td>
<td>-.09</td>
<td>-.06</td>
<td>.00</td>
</tr>
<tr>
<td>LIFESTYLE</td>
<td>.10</td>
<td>-.05</td>
<td>.22**</td>
<td>-.08</td>
<td>.04</td>
<td>.03</td>
<td>-.09</td>
</tr>
<tr>
<td>PRESTIGE</td>
<td>.00</td>
<td>.03</td>
<td>.18*</td>
<td>-.10</td>
<td>-.05</td>
<td>-.15</td>
<td>.10</td>
</tr>
<tr>
<td>ALTRUIN</td>
<td>.09</td>
<td>.00</td>
<td>.05</td>
<td>-.04</td>
<td>.13</td>
<td>.05</td>
<td>.04</td>
</tr>
<tr>
<td>SECURU</td>
<td>.04</td>
<td>.17*</td>
<td>.02</td>
<td>.00</td>
<td>.03</td>
<td>.01</td>
<td>-.15</td>
</tr>
<tr>
<td>MANAGE</td>
<td>-.09</td>
<td>.05</td>
<td>.03</td>
<td>.00</td>
<td>-.06</td>
<td>-.08</td>
<td>.12</td>
</tr>
<tr>
<td>DETACH</td>
<td>.04</td>
<td>.00</td>
<td>.01</td>
<td>-.09</td>
<td>-.03</td>
<td>.04</td>
<td>-.30***</td>
</tr>
<tr>
<td>PHYSACT</td>
<td>.08</td>
<td>-.03</td>
<td>-.08</td>
<td>-.01</td>
<td>-.01</td>
<td>.17</td>
<td>.01</td>
</tr>
<tr>
<td>SURROUN</td>
<td>.02</td>
<td>.01</td>
<td>.00</td>
<td>.07</td>
<td>-.08</td>
<td>-.01</td>
<td>-.04</td>
</tr>
</tbody>
</table>

Note.

INDEP : WAPS Independence
COWORK : WAPS Co-Workers
SELFDEV: WAPS Self-Development
CREATIV: WAPS Creativity
MONEY : WAPS Money
LIFESTY: WAPS Lifestyle
PRESTI : WAPS Prestige
ALTRUIN: WAPS Altruism
SECURU : WAPS Security
MANAGE : WAPS Management

DETACH : WAPS Detachment
PHYSACT: WAPS Physical Act.
SURROUN: WAPS Surroundings
ICI : Internal Control I
COMP : MAB Comprehension
ARIT : MAB Arithmetic
VOCA : MAB Vocabulary
DISP : MAB Digit Span
PICO : MAB Picture Compl.
SPAT : MAB Spatial

* p < .05.  ** p < .01.  *** p < .001.
the MAB Vocabulary Scale with WAPS Independence Scale was also not predicted by Barrett's (1978) formulation of congruence theory. For personality and attitudes, scores on the Internal Control Index (ICI) scale were positively correlated with enjoyment of computers \( r = .30, p < .008 \) and the WAPS Creativity Scale \( r = .27, p < .0001 \). Enjoyment of computers was also correlated with the WAPS Self-Development Scale \( r = .23, p < .018 \), the WAPS Creativity Scale \( r = .37, p < .0001 \), and the WAPS Detachment Scale \( r = -.25, p < .008 \). The overall pattern of these correlations was consistent with the prediction made by congruence theory that personality and attitudes were related more strongly to preferences for job decision latitude than are abilities. However, this conclusion is tempered by the strong likelihood that the few significant correlations observed were due to chance.

**Ability and Affective Responses to Work: Hypothesis 3**

Hypothesis three was a test of the congruence theory prediction that task-relevant abilities moderate the relationship between task characteristics, task perceptions, and affective responses to the work. If abilities are matched with task requirements, then affective responses to the work should be more positive than when abilities are not matched with task requirements. The form of the relationship between abilities and task satisfaction determines the nature of the matching in relation to task
demands. Thus, the specific form of hypothesis three follows: (a) If the demands imposed by a task on abilities are relatively low due to low task complexity, then the form of the relationship between abilities and affective responses to the work may be linear and in a negative direction—that is, people with low levels of ability will have the most positive affective responses to the task, while people with high levels of ability will have the least positive affect; (b) if ability requirements for a task are relatively high due to high task complexity, the form of the relationship between ability and affective responses to the task should be curvilinear, such that people with moderate levels of ability may be expected to experience the most positive affective responses to the task; while, people with low ability may find the task too demanding, and will therefore experience negative affective responses to the work; and, people with high ability may also have negative affective responses to the work.

The present experiment attempted to create working conditions in which these different forms of relationship between task-relevant abilities and affective responses to the work could be tested. To recapitulate, it was predicted that the relationship between task-relevant abilities and affective responses to the work would be linear and negative in the low complexity task condition because of the relatively low ability demands placed on the subjects by the task. In the high task complexity condition, the high level
of task demands would result in a curvilinear relationship between task-relevant abilities and affective responses to the work.

Composite scores of MAB abilities were used in testing for the moderation of task effects by abilities on affective responses. Since the individual MAB subscales display approximately equal high loadings on their respective Verbal and Performance factors, and these factors are orthogonal, the individual subscales can be combined by unit weighting. Composite MAB Verbal and Performance ability scores were obtained by summing the three Verbal and the three Performance subscale scores, respectively. Hypothesis three was tested with four analyses of covariance. An analysis was performed for each of the four combinations of two MAB composite ability scores and of the two sets of perceptual and affective response factor scores. Thus, the independent variables in these analyses consisted of task complexity, job decision latitude, their interaction, and their interaction with both the linear and quadratic components of each MAB composite ability score singly as predictors.

Support for the congruence model in this experiment should come from the finding of a significant difference in the slope of the regression line between ability and affective response to the tasks as a function of task complexity. For the linear aspect of hypothesis three to
hold, the interaction term for the linear component of ability with task assignment should be significant. Furthermore, for the curvilinear aspect of the congruence hypothesis to hold, there should be a significant proportion of variance accounted for by the interaction of the quadratic polynomial term for ability (squared ability score) with task assignment.

The test for the overall model did not reach statistical significance in any of the four analyses of covariance, which are presented in Tables 24, 25, 26, and 27. In the analysis of task complexity perceptions (Factor 1) with MAB Verbal ability as covariate, shown in Table 24, there was a significant effect for the linear component of verbal ability ($F(1, 55) = 6.46, p < .013$). In the analysis on job decision latitude perceptions (Factor 2) with composite MAB Verbal ability as the covariate, shown in Table 27, there was a tendency toward a significant interaction between both the linear and squared components of verbal ability and task complexity. Since the overall test of the model was not significant in any of the analyses described above, the individual variables contributed only a trivial amount of variance to prediction, even if this effect appeared significant. In order to avoid spurious significance, the overall $F$ for a set of independent variables must be significant before its constituent variables are tested for significance (Cohen & Cohen, 1983, p. 108). Thus, there was no evidence of either a linear or
Table 24

Analysis of Covariance on Perceived Task Complexity Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERB</td>
<td>2.317</td>
<td>1</td>
<td>2.13</td>
<td>2.78</td>
</tr>
<tr>
<td>VERBSQ</td>
<td>1.558</td>
<td>1</td>
<td>1.558</td>
<td>1.87</td>
</tr>
<tr>
<td>TC</td>
<td>0.782</td>
<td>1</td>
<td>0.782</td>
<td>0.88</td>
</tr>
<tr>
<td>ERROR</td>
<td>59.887</td>
<td>67</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>0.509</td>
<td>1</td>
<td>0.509</td>
<td>0.61</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>1.579</td>
<td>1</td>
<td>1.579</td>
<td>1.89</td>
</tr>
<tr>
<td>VERB*TC</td>
<td>0.541</td>
<td>1</td>
<td>0.541</td>
<td>0.65</td>
</tr>
<tr>
<td>VERB*JDL</td>
<td>0.260</td>
<td>1</td>
<td>0.260</td>
<td>0.31</td>
</tr>
<tr>
<td>VERB<em>TC</em>JDL</td>
<td>1.763</td>
<td>1</td>
<td>1.763</td>
<td>2.11</td>
</tr>
<tr>
<td>VERBSQ*TC</td>
<td>0.815</td>
<td>1</td>
<td>0.815</td>
<td>0.98</td>
</tr>
<tr>
<td>VERBSQ*JDL</td>
<td>0.426</td>
<td>1</td>
<td>0.426</td>
<td>0.51</td>
</tr>
<tr>
<td>VERBSQ<em>TC</em>JDL</td>
<td>1.526</td>
<td>1</td>
<td>1.526</td>
<td>1.83</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>45.874</td>
<td>55</td>
<td>0.834</td>
<td></td>
</tr>
</tbody>
</table>

Note. VERB: Composite MAB Verbal ability
VERBSQ: Squared composite MAB Verbal ability
TC: Task Complexity
TA(TC): Time Allocation, blocked under Task Complexity
JDL: Job Decision Latitude
Table 25

Analysis of Covariance on Perceived Job Decision Latitude Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERB</td>
<td>2.473</td>
<td>1</td>
<td>2.473</td>
<td>2.92</td>
</tr>
<tr>
<td>VERBSQ</td>
<td>2.367</td>
<td>1</td>
<td>2.367</td>
<td>2.79</td>
</tr>
<tr>
<td>TC</td>
<td>0.260</td>
<td>1</td>
<td>0.260</td>
<td>0.25</td>
</tr>
<tr>
<td>ERROR</td>
<td>69.179</td>
<td>67</td>
<td>1.032</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>0.632</td>
<td>1</td>
<td>0.632</td>
<td>0.75</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>1.281</td>
<td>1</td>
<td>1.281</td>
<td>1.51</td>
</tr>
<tr>
<td>VERB*TC</td>
<td>0.492</td>
<td>1</td>
<td>0.492</td>
<td>0.58</td>
</tr>
<tr>
<td>VERB*JDL</td>
<td>0.785</td>
<td>1</td>
<td>0.785</td>
<td>0.93</td>
</tr>
<tr>
<td>VERB<em>TC</em>JDL</td>
<td>1.232</td>
<td>1</td>
<td>1.232</td>
<td>1.45</td>
</tr>
<tr>
<td>VERBSQ*TC</td>
<td>0.247</td>
<td>1</td>
<td>0.247</td>
<td>0.29</td>
</tr>
<tr>
<td>VERBSQ*JDL</td>
<td>0.741</td>
<td>1</td>
<td>0.741</td>
<td>0.87</td>
</tr>
<tr>
<td>VERSQ<em>TC</em>JDL</td>
<td>1.356</td>
<td>1</td>
<td>1.356</td>
<td>1.60</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>46.654</td>
<td>55</td>
<td>0.848</td>
<td></td>
</tr>
</tbody>
</table>

Note. VERB: Composite MAB Verbal ability
       VERBSQ: Squared composite MAB Verbal ability
       TC: Task Complexity
       TA(TC): Time Allocation, blocked under Task Complexity
       JDL: Job Decision Latitude
Table 26

Analysis of Covariance on Perceived Task Complexity Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERF</td>
<td>0.244</td>
<td>1</td>
<td>0.244</td>
<td>0.27</td>
</tr>
<tr>
<td>PERFSQ</td>
<td>0.176</td>
<td>1</td>
<td>0.176</td>
<td>0.19</td>
</tr>
<tr>
<td>TC</td>
<td>4.938</td>
<td>1</td>
<td>4.938</td>
<td>5.05*</td>
</tr>
<tr>
<td>ERROR</td>
<td>65.526</td>
<td>67</td>
<td>0.978</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1.951</td>
<td>1</td>
<td>1.951</td>
<td>2.14</td>
</tr>
<tr>
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<td>0.102</td>
<td>1</td>
<td>0.102</td>
<td>0.11</td>
</tr>
<tr>
<td>PERF*TC</td>
<td>5.130</td>
<td>1</td>
<td>5.130</td>
<td>5.62*</td>
</tr>
<tr>
<td>PERF*JDL</td>
<td>2.235</td>
<td>1</td>
<td>2.235</td>
<td>2.45</td>
</tr>
<tr>
<td>PERF<em>TC</em>JDL</td>
<td>0.030</td>
<td>1</td>
<td>0.030</td>
<td>0.03</td>
</tr>
<tr>
<td>PERFSQ*TC</td>
<td>5.030</td>
<td>1</td>
<td>5.030</td>
<td>0.02*</td>
</tr>
<tr>
<td>PERFSQ*JDL</td>
<td>1.901</td>
<td>1</td>
<td>1.901</td>
<td>2.08</td>
</tr>
<tr>
<td>PERFSQ<em>TC</em>JDL</td>
<td>0.080</td>
<td>1</td>
<td>0.080</td>
<td>0.09</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>50.195</td>
<td>55</td>
<td>0.912</td>
<td></td>
</tr>
</tbody>
</table>

Note. PERF: Composite MAB Performance ability  
PERFSQ: Squared composite MAB Performance ability  
TC: Task Complexity  
TA(TC): Time Allocation, blocked under Task Complexity  
JDL: Job Decision Latitude

* p < .05.
Table 27

Analysis of Covariance on Perceived Job Decision Latitude Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERF</td>
<td>0.058</td>
<td>1</td>
<td>0.058</td>
<td>0.07</td>
</tr>
<tr>
<td>PERFSQ</td>
<td>0.093</td>
<td>1</td>
<td>0.093</td>
<td>0.11</td>
</tr>
<tr>
<td>TC</td>
<td>1.329</td>
<td>1</td>
<td>1.329</td>
<td>0.26</td>
</tr>
<tr>
<td>ERROR</td>
<td>71.249</td>
<td>67</td>
<td>1.063</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>0.073</td>
<td>1</td>
<td>0.073</td>
<td>0.09</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>0.690</td>
<td>1</td>
<td>0.690</td>
<td>0.85</td>
</tr>
<tr>
<td>PERF*TC</td>
<td>1.098</td>
<td>1</td>
<td>0.098</td>
<td>1.35</td>
</tr>
<tr>
<td>PERF*JDL</td>
<td>0.009</td>
<td>1</td>
<td>0.009</td>
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<tr>
<td>PERF<em>TC</em>JDL</td>
<td>0.414</td>
<td>1</td>
<td>0.414</td>
<td>0.51</td>
</tr>
<tr>
<td>PERFSQ*TC</td>
<td>1.322</td>
<td>1</td>
<td>1.322</td>
<td>1.62</td>
</tr>
<tr>
<td>PERFSQ*JDL</td>
<td>0.062</td>
<td>1</td>
<td>0.062</td>
<td>0.08</td>
</tr>
<tr>
<td>PERFSQ<em>TC</em>JDL</td>
<td>0.673</td>
<td>1</td>
<td>0.673</td>
<td>0.83</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>44.877</td>
<td>55</td>
<td>0.815</td>
<td></td>
</tr>
</tbody>
</table>

Note. PERF: Composite MAB Performance ability
PERFSQ: Squared composite MAB Performance ability
TC: Task Complexity
TA(TC): Time Allocation, blocked under Task Complexity
JDL: Job Decision Latitude
a quadratic trend for ability, nor was there any interaction between ability and task complexity or job decision latitude.

Nonetheless, further insight into how the two composite ability variables operate in the regression analyses described above can be gained by treating each ability composite as a dependent variable in an analysis of variance of task effects. Significant task effects in such an analysis would indicate that the range of scores was not equally distributed across the experimental groups. Otherwise, the absence of group differences would suggest that the ability variable might tend to operate as a suppressor variable. For each of the two ability composites, an analysis of variance with task complexity and job decision latitude as the independent variables was conducted. The analyses, presented in Appendix N, revealed significant differences between JDL groups in performance ability. In other words, random assignment of subjects to treatment groups did not result in an equal distribution of performance ability in all groups. When the effects of performance ability was partialled out of task effects in the analyses of covariance reported earlier, no support was found for any of the propositions made by congruence theory.
Effects of Personal Control Beliefs: Hypotheses 4a and 4b

Hypotheses four (a) and four (b) were formulated to test propositions about the relationships between personal control beliefs, work performance and affective responses to work. Specifically, hypothesis four (a) predicted that subjects with an internal locus of control would perform better in the HTC/HJDL condition than subjects with an external locus of control. Hypothesis four (b) predicted that subjects with an internal locus of control would express positive affective responses toward the work in the HTC/HJDL condition than subjects with an external locus of control. Analysis of covariance was used to test both hypotheses. A split-plot factorial analysis of covariance with ICI score as the covariate, was performed on each of the four performance measures and on each of the two sets of affective response factor scores as the dependent variable. Thus the independent variables were task complexity, job decision latitude, and locus of control (each of these variables having two levels), and time allocation.

The analyses on each of the performance measures for hypothesis four (a), presented in Tables 28, 29, 30, and 31, yield results that suggest at most a small tendency for locus of control to interact with objective task characteristics to influence work performance. Locus of control appeared to indirectly moderate task effects for quantity and quality of proofreading task performance (see Table 28, and Table 29, respectively), and for quality of
Table 28

Analysis of Covariance on Quantity of Proofreading Task Performance

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICI</td>
<td>10098.127</td>
<td>1</td>
<td>10098.127</td>
<td>1.52</td>
</tr>
<tr>
<td>TC</td>
<td>2290.529</td>
<td>1</td>
<td>2290.529</td>
<td>0.33</td>
</tr>
<tr>
<td>ERROR</td>
<td>419405.227</td>
<td>61</td>
<td>6875.495</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1006.085</td>
<td>1</td>
<td>1006.085</td>
<td>0.15</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>24.316</td>
<td>1</td>
<td>24.316</td>
<td>0.00</td>
</tr>
<tr>
<td>ICI*TC</td>
<td>3.800</td>
<td>1</td>
<td>3.800</td>
<td>0.00</td>
</tr>
<tr>
<td>ICI*JDL</td>
<td>25562.223</td>
<td>1</td>
<td>25562.223</td>
<td>3.85</td>
</tr>
<tr>
<td>ICI<em>TC</em>JDL</td>
<td>8717.765</td>
<td>1</td>
<td>8717.765</td>
<td>1.31</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>305514.274</td>
<td>46</td>
<td>641.614</td>
<td></td>
</tr>
</tbody>
</table>

Note. ICI: Internal Control Index  
TC: Task Complexity  
TA: Time Allocation, blocked under Task Complexity  
JDL: Job Decision Allocation
Table 29

Analysis of Covariance on Quality of Proofreading Task Performance

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICI</td>
<td>14.205</td>
<td>1</td>
<td>14.205</td>
<td>0.04</td>
</tr>
<tr>
<td>TC</td>
<td>1806.624</td>
<td>1</td>
<td>1806.624</td>
<td>5.29*</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>17993.410</td>
<td>61</td>
<td>294.973</td>
<td>0.86</td>
</tr>
<tr>
<td>JDL</td>
<td>587.904</td>
<td>1</td>
<td>587.904</td>
<td>1.72</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>473.978</td>
<td>1</td>
<td>472.978</td>
<td>1.39</td>
</tr>
<tr>
<td>ICI*TC</td>
<td>97.730</td>
<td>1</td>
<td>97.730</td>
<td>0.29</td>
</tr>
<tr>
<td>ICI*JDL</td>
<td>1225.860</td>
<td>1</td>
<td>1225.860</td>
<td>3.59</td>
</tr>
<tr>
<td>ICI<em>TC</em>JDL</td>
<td>153.018</td>
<td>1</td>
<td>153.018</td>
<td>0.45</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>15717.897</td>
<td>46</td>
<td>341.671</td>
<td></td>
</tr>
</tbody>
</table>

Note. ICI : Internal Control Index  
TC : Task Complexity  
TA(TC): Time Allocation, blocked under Task Complexity  
JDL : Job Decision Latitude

* p < .05.
### Table 30

**Analysis of Covariance on Quantity of Data Entry Task Performance**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICI</td>
<td>15.795</td>
<td>1</td>
<td>15.795</td>
<td>0.10</td>
</tr>
<tr>
<td>TC</td>
<td>2781.088</td>
<td>1</td>
<td>2781.088</td>
<td>10.14**</td>
</tr>
<tr>
<td>ERROR</td>
<td>17553.315</td>
<td>64</td>
<td>274.270</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1067.088</td>
<td>1</td>
<td>1067.088</td>
<td>6.56*</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>889.465</td>
<td>1</td>
<td>889.465</td>
<td>5.47*</td>
</tr>
<tr>
<td>ICI*TC</td>
<td>2.953</td>
<td>1</td>
<td>2.953</td>
<td>0.89</td>
</tr>
<tr>
<td>ICI*JDL</td>
<td>96.923</td>
<td>1</td>
<td>96.923</td>
<td>0.60</td>
</tr>
<tr>
<td>ICI<em>TC</em>JDL</td>
<td>0.04</td>
<td>1</td>
<td>0.04</td>
<td>0.00</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>5692.347</td>
<td>46</td>
<td>123.746</td>
<td></td>
</tr>
</tbody>
</table>

**Note.**  
ICI: Internal Control Index  
TC: Task Complexity  
TA(TC): Time Allocation, blocked under Task Complexity  
JDL: Job Decision Latitude

* p < .05.  ** p < .01.
### Table 31

**Analysis of Covariance on Quality of Data Entry Task Performance**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICI</td>
<td>4.222</td>
<td>1</td>
<td>4.222</td>
<td>0.21</td>
</tr>
<tr>
<td>TC</td>
<td>39.654</td>
<td>1</td>
<td>39.654</td>
<td>2.01</td>
</tr>
<tr>
<td>ERROR</td>
<td>1756.922</td>
<td>64</td>
<td>27.451</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>117.226</td>
<td>1</td>
<td>117.226</td>
<td>5.93*</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>65.232</td>
<td>1</td>
<td>65.232</td>
<td>3.30</td>
</tr>
<tr>
<td>ICI*TC</td>
<td>18.713</td>
<td>1</td>
<td>18.713</td>
<td>0.95</td>
</tr>
<tr>
<td>ICI*JDL</td>
<td>0.482</td>
<td>1</td>
<td>0.482</td>
<td>0.02</td>
</tr>
<tr>
<td>ICI<em>TC</em>JDL</td>
<td>75.311</td>
<td>1</td>
<td>75.311</td>
<td>3.81</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>850.239</td>
<td>43</td>
<td>19.773</td>
<td></td>
</tr>
</tbody>
</table>

**Note.**
- ICI: Internal Control Index
- TC: Task Complexity
- TA(TC): Time Allocation, blocked under Task Complexity
- JDL: Job Decision Latitude

* p < .02.
data entry task performance (see Table 31). No effect for ICI was observed for quantity of data entry task performance (see Table 30).

These four analyses pertaining to the role of ICI as a covariate in task effects on performance were compared to the corresponding four analyses excluding ICI reported for Hypothesis 1.1. The comparison of the pattern of results between analyses including and excluding ICI scores might help clarify the operation of ICI effects. For quality of data entry task performance, the analysis of variance (i.e., without ICI) found that only the interaction of task complexity and JDL was significant (Table 15). When the ICI score was added as a covariate, as shown in Table 31, this interaction was not statistically significant, but there was a significant main effect for JDL and a significant interaction between ICI, task complexity, and JDL. For quantity of proofreading task performance, a significant main effect found in the analysis of variance (Table 8) disappeared after the inclusion of ICI as a covariate (Table 28). Finally, for the quality of proofreading task performance, a main effect for task complexity found in the analysis of variance (Table 10) remained significant when ICI was added as a covariate (Table 29). There was also a significant interaction between ICI and JDL, F(1, 46) = 3.59, p < .055, using a more liberal alpha criterion of .10 as suggested by O'Connor, Rudolf, and Peters (1980, p. 252) for the detection of interactions between job scope and
individual differences. Such a criterion is acceptable in this application so as to reduce the likelihood of Type II error (failure to reject a false null hypothesis). Thus, the effect of locus of control was indirect, such that locus of control appeared to function as a suppressor variable.

Hypothesis four (b) predicted that locus of control would moderate affective responses to the tasks. This was tested by including locus of control as the covariate with task effects in analyses of covariance on each of the two sets of affective response factor scores. The results of these two analyses are shown in Tables 32 and 33 respectively. In both analyses, the pattern of results was essentially the same as those obtained from the analyses conducted for hypothesis one, part 1.3. Locus of control did not have a significant effect in the analysis for either of the two affective response variables. Contrary to expectations, there was no difference between people with an internal locus of control and people with an external locus of control in terms of either their performance or their perceptions of the tasks or affective responses to the work.

To further assess whether locus of control was operating as a suppressor variable in relation to the task variables, an analysis of variance of task effects was performed with ICI scores as the dependent variable. This analysis, shown in Appendix 0, found a significant task
Table 32

Analysis of Covariance on Perceived Task Complexity Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICI</td>
<td>0.000</td>
<td>1</td>
<td>0.000</td>
<td>0.00</td>
</tr>
<tr>
<td>TC</td>
<td>1.270</td>
<td>1</td>
<td>1.270</td>
<td>1.33</td>
</tr>
<tr>
<td>ERROR</td>
<td>63.784</td>
<td>61</td>
<td>1.045</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>3.399</td>
<td>1</td>
<td>3.399</td>
<td>3.55</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>0.283</td>
<td>1</td>
<td>0.283</td>
<td>0.30</td>
</tr>
<tr>
<td>ICI*TC</td>
<td>0.061</td>
<td>1</td>
<td>0.061</td>
<td>0.06</td>
</tr>
<tr>
<td>ICI*JDL</td>
<td>0.836</td>
<td>1</td>
<td>0.836</td>
<td>0.87</td>
</tr>
<tr>
<td>ICI<em>TC</em>JDL</td>
<td>0.008</td>
<td>1</td>
<td>0.008</td>
<td>0.01</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>54.551</td>
<td>57</td>
<td>0.957</td>
<td></td>
</tr>
</tbody>
</table>

Note. ICI : Internal Control Index
TC : Task Complexity
TA(TC): Time Allocation, blocked under Task Complexity
JDL : Job Decision Latitude
Table 33

Analysis of Covariance on Perceived Job Decision Latitude Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>Adjusted Sum of Squares</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICI</td>
<td>2.598</td>
<td>1</td>
<td>2.598</td>
<td>2.91</td>
</tr>
<tr>
<td>TC</td>
<td>0.030</td>
<td>1</td>
<td>0.030</td>
<td>0.86</td>
</tr>
<tr>
<td>ERROR</td>
<td>68.462</td>
<td>67</td>
<td>1.021</td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1.726</td>
<td>1</td>
<td>1.726</td>
<td>1.93</td>
</tr>
<tr>
<td>TC*JDL</td>
<td>0.974</td>
<td>1</td>
<td>0.974</td>
<td>1.09</td>
</tr>
<tr>
<td>ICI*TC</td>
<td>0.046</td>
<td>1</td>
<td>0.046</td>
<td>0.05</td>
</tr>
<tr>
<td>ICI*JDL</td>
<td>0.423</td>
<td>1</td>
<td>0.423</td>
<td>0.47</td>
</tr>
<tr>
<td>ICI<em>TC</em>JDL</td>
<td>0.140</td>
<td>1</td>
<td>0.140</td>
<td>0.16</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>50.928</td>
<td>57</td>
<td>0.893</td>
<td></td>
</tr>
</tbody>
</table>

Note. ICI: Internal Control Index  
TC: Task Complexity  
TA(TC): Time Allocation, blocked under Task Complexity  
JDL: Job Decision Latitude
effect on ICI, which indicates that ICI scores were unevenly distributed across the experimental treatment groups. Therefore, locus of control was not operating as a suppressor variable. Rather, its effects were attributable to uneven sampling across experimental treatment groups.

Finally, it should be noted that no adjustment was made to control for experiment-wise alpha level, even though multiple ANOVAs and ANCOVAs were run. Had a more conservative alpha level been used, the interpretation of the findings would remain essentially unchanged.

Perceived Task Characteristics as Predictors of Affective Responses to Work

There are two schools of thought about the causal mechanisms underlying the motivational effects of job design: One school of thought (e.g., Scott, 1966; Schwab & Cummings, 1976) emphasizes the role of objective task characteristics, while the other school emphasizes the salience of perceived task characteristics (e.g., Hackman & Oldham, 1980; Griffin, 1982) as the causal mechanism.

It was the intent of this thesis to focus on the perceptual and affective consequences of variations in objective task characteristics. The general pattern of findings was that variations in objective task characteristics were reflected in concomitant variations in objective performance measures, but not in perceived task characteristics or affective responses. This discrepancy between the effect of tasks on performance and their lack of
effect on task perceptions and affective responses to the work might be clarified by an examination of the relationship between perceived task characteristics and affective responses to the work.

There are limitations inherent in the analysis of the relationship between perceived task characteristics and affective responses to work. Inferences about the causal relationship between task perceptions and affective responses are precluded because both sets of data were collected at the same time. There is also the possibility of mono-method bias since both sets of data came from the same individuals. These problems might result in artificially-elevated estimates of common variance (Griffin, 1982). Such potential pitfalls must be weighed against the value of knowledge about the association between task perceptions and affective responses to work.

Multiple regression analysis was used to assess the strength of the association between perceived task characteristics and affective responses to the work. The task perception predictors and the affective response criteria were selected to represent, in modified form, the task characteristics and affective responses to work in Hackman and Oldham's job characteristics model (1980; see introduction). The predictors chosen for inclusion in all regression analyses were the scales of perceived task characteristics: (a) pace, (b) freedom, (c) variety, (d)
task complexity, (e) challenge, (f) meaningfulness, (g) responsibility, and (h) skill-utilization. These scales include two measures of critical psychological states in the Job Characteristics model, experienced meaningfulness and experienced responsibility. They were used as predictors because the model considers critical psychological states to be primary determinants of employee motivation and satisfaction (Hackman & Oldham, 1980). O'Brien's scale of perceived skill-utilization (1980) was also chosen as a predictor because it measures the congruence between perceived and desired opportunities to use skills. A comparison could thus be made of the relative efficiency of perceived task characteristics with the congruence between an actual and desired task characteristic in the prediction of affective responses. Finally, an item measuring perceived feedback in the work was also used as a predictor, because it is a core task characteristic in the Hackman and Oldham model. The criterion variables in the regression analyses were subjects' scores on scales measuring global task attractiveness, intrinsic reward satisfaction, and perceived productivity.

The regressions of, respectively, task attractiveness, intrinsic reward satisfaction, and perceived productivity on perceived task perceptions are presented in Tables 34, 35, and 36. Each table displays the unstandardized regression coefficients, the squared semipartial correlations, R-squared, and adjusted R-squared. The multiple correlation
Table 34

Standard Multiple Regression of Task Attractiveness on Perceived Task Characteristics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SRI²</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACE</td>
<td>-0.025</td>
<td>.00</td>
</tr>
<tr>
<td>FREEDOM</td>
<td>-0.033</td>
<td>.00</td>
</tr>
<tr>
<td>VARIETY</td>
<td>0.044</td>
<td>.00</td>
</tr>
<tr>
<td>TASK COMPLEXITY</td>
<td>0.203</td>
<td>.09***</td>
</tr>
<tr>
<td>CHALLENGE</td>
<td>-0.004</td>
<td>.00</td>
</tr>
<tr>
<td>MEANINGFULNESS</td>
<td>0.300</td>
<td>.03**</td>
</tr>
<tr>
<td>RESPONSIBILITY</td>
<td>-0.087</td>
<td>.00</td>
</tr>
<tr>
<td>SKILL-UTILIZATION</td>
<td>-0.124</td>
<td>.00</td>
</tr>
<tr>
<td>Intercept</td>
<td>11.364</td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .24 \]
\[ \text{Adjusted } R^2 = .19 \]
\[ R = .49 \]

Note. ** p < .02. *** p < .001.
Table 35

Standard Multiple Regression of Intrinsic Task Satisfaction on Perceived Task Characteristics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SRI²</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACE</td>
<td>0.062</td>
<td>.00</td>
</tr>
<tr>
<td>FREEDOM</td>
<td>-0.251</td>
<td>.03*</td>
</tr>
<tr>
<td>VARIETY</td>
<td>0.012</td>
<td>.00</td>
</tr>
<tr>
<td>TASK COMPLEXITY</td>
<td>0.163</td>
<td>.03**</td>
</tr>
<tr>
<td>CHALLENGE</td>
<td>0.118</td>
<td>.00</td>
</tr>
<tr>
<td>MEANINGFULNESS</td>
<td>0.417</td>
<td>.03**</td>
</tr>
<tr>
<td>RESPONSIBILITY</td>
<td>-0.031</td>
<td>.00</td>
</tr>
<tr>
<td>SKILL-UTILIZATION</td>
<td>0.404</td>
<td>.03*</td>
</tr>
</tbody>
</table>

Intercept = 2.571

\[
R^2 = .4; \\
\text{Adjusted } R^2 = .37 \\
R = .64
\]

**Note.**  * p < .05.  ** p < .02.
Table 36

Standard Multiple Regression of Perceived
Productivity on Perceived Task Characteristics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SRI²</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACE</td>
<td>-0.098</td>
<td>.00</td>
</tr>
<tr>
<td>FREEDOM</td>
<td>0.128</td>
<td>.01</td>
</tr>
<tr>
<td>VARIETY</td>
<td>-0.194</td>
<td>.01</td>
</tr>
<tr>
<td>TASK COMPLEXITY</td>
<td>-0.079</td>
<td>.01</td>
</tr>
<tr>
<td>CHALLENGE</td>
<td>0.190</td>
<td>.01</td>
</tr>
<tr>
<td>MEANINGFULNESS</td>
<td>-0.254</td>
<td>.01</td>
</tr>
<tr>
<td>RESPONSIBILITY</td>
<td>-0.486</td>
<td>.03**</td>
</tr>
<tr>
<td>SKILL-UTILIZATION</td>
<td>-0.287</td>
<td>.02</td>
</tr>
<tr>
<td>Intercept = 29.290</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = .21 \]
\[ \text{Adjusted } R^2 = .16 \]
\[ R = .46 \]

Note.  ** p < .02.
for the regression of each of the three perceived work outcomes on perceived task characteristics was significantly different from zero: $R^2 = .24$ for task attractiveness, $F(8, 125) = 4.95$, $p < .0001$; $R^2 = .41$ for intrinsic task satisfaction, $F(8, 125) = 11.14$; $R^2 = .21$ for perceived productivity, $F(8, 125) = 4.23$, $p < .0002$.

Only two of the independent variables contributed significantly to the prediction of task attractiveness, perceived task complexity ($sr_{i}^2 = .09$) and perceived meaningfulness ($sr_{i}^2 = .09$). Thus perceptions of the tasks as complex and meaningful were positively associated with task attractiveness.

Intrinsic task satisfaction was significantly predicted in a positive direction by perceptions of task complexity ($sr_{i}^2 = .03$), meaningfulness ($sr_{i}^2 = .04$), and skill-utilization ($sr_{i}^2 = .03$); and in a negative direction by perceptions of freedom ($sr_{i}^2 = .03$) in decision-making. Thus, people who saw the work as complex, meaningful and demanding of their skills, but low in decision-making latitude reported high intrinsic task satisfaction. That skill-utilization was found to make a unique contribution to prediction here is consistent with O'Brien's (1983, 1986) argument that skill-utilization is a distinct component of task perceptions. An interpretation of the surprising finding that perceived freedom was negatively related to intrinsic task satisfaction is that most subjects saw the
degree of decision-making in the work as excessive, and felt the work itself to be unpleasant.

Finally, only perceived responsibility predicted ($r^2 = .03$) perceived productivity. The results from the three regression analyses described above show different patterns of relationships between task perceptions and different affective responses to the work. Perceptions of task characteristics were more strongly associated with the specific facet of intrinsic task satisfaction than with the more global measure of task attractiveness.
CHAPTER IV

DISCUSSION

The purpose of the present study was to investigate the relationship between task design and worker characteristics in computer-based clerical work. It has been argued that the implementation of computers for clerical work in the office provides an array of choices in job design, which have differing consequences for both worker productivity and the experience of work. A review of prognostications for the future of office work indicated that computer-based clerical work may be enriched or simplified. It was the intent of this thesis to simulate computer-based clerical work under controlled experimental conditions. This was done by varying task complexity and the degree of job decision-making latitude (JDL). These two aspects of job content were chosen for investigation because they have consistently been identified in the literature as influential determinants of psychological well-being at work. It was proposed that work performance, workload, and perceptual and attitudinal responses to work, would be a joint function of variations in working conditions and individual differences in ability, work preferences, and personal control beliefs.
Task Characteristics: Hypothesis 1

The first hypothesis addressed the effects of variations in task characteristics separately on: (1.1) work performance, (1.2) perceived workload, and (1.3) perceptual and attitudinal responses to the work.

Work Performance

With regards to (1.1) work performance, the results were as hypothesized. It was predicted following the precepts of scientific management that both performance quantity and quality would be higher in the low task complexity condition. The quantity of performance was higher in the low task complexity condition than in the high task complexity condition for both the proofreading and data entry tasks, as measured by number of transactions entered, and number of lines corrected, respectively. These findings were contrary to alternate predictions made from the job enrichment perspective.

On the data entry task, quality of performance, as defined by the number of correct entries made, was also better in the low JDL condition than in the high JDL condition. Furthermore, there was an interaction between task complexity and JDL such that the quantity of data entry performance was highest when both task complexity and JDL were low. The quality of performance was significantly higher in the low complexity condition than in the high complexity condition for the proofreading task. On the data
entry task, the quality of performance was significantly higher in the low JDL condition than in the high JDL condition; However, there were no differences due to task complexity. On this task, task complexity and job decision latitude interacted such that quality, like quantity, of performance was elevated when both task complexity and JDL were low.

The overall finding that work performance was higher when the tasks were simplified rather than when they were enriched supports the job design predictions formulated from the perspective of scientific management. This perspective advocates job simplification because it leads to increased productivity (Locke, 1978). However, these results may be due to the experimental manipulation which resulted in a restricted and extreme range of task complexity. Observations of the difficulties that subjects encountered in performing the tasks suggests that the work may have been very difficult, even in the low task complexity condition. Further evidence of this will be presented later.

Perceived Workload

The analyses of the workload data provide valuable insight into the subjective experience of work performance.

Hypothesis 1.2a predicted that workload would be highest when task complexity was high. No differences in subjective workload were found as a function of task complexity. Subjects reported similar levels of workload
across task conditions in which there were significant differences in their objective performance. This finding is consistent with other indications that task complexity may have been high for the subjects, even in the low task complexity condition. The proofreading task may have been an exception: Workload ratings decreased over time in all four conditions, which suggests that this task may have been slightly less demanding than the other two.

Hypothesis 1.2b predicted that high JDL will reduce workload relative to low JDL. This hypothesis was supported for two of the three experimental tasks, text entry and data entry, by the finding that workload decreased over time for subjects with high JDL, while either increasing or remaining the same for subjects with low JDL. If it is accepted that task complexity was high, even for the subjects in the low task complexity condition, then the above findings provide support for Karasek's (1979) proposition that high job decision latitude can offset the effects of high task demands. The subjects in the high JDL condition had greater discretion in deciding the sequence and the duration of work than subjects in the low JDL condition. This increased control allowed high JDL subjects to regulate their task behaviour in more individual ways, and thus to reduce their workload.

Task Perceptions and Affective Responses to the Work

The data on affective responses to the work
conditions show an interesting disparity with the objective performance data. The nature of this disparity was that the differences in objective performance were not reflected in concomitant differences in perceptions of the tasks and in affective responses to the work. Hypothesis 1.3 predicted that affective responses to the work would be the most positive in the high task complexity and high JDL condition. The task complexity manipulation did not result in the expected difference between conditions in perceptions of task complexity, nor was there an interaction of task complexity and JDL. There was, however, a significant main effect for JDL on perceptions of task complexity. Subjects in the high JDL condition perceived lower task complexity in their work than subjects in the low JDL condition. At the same time, these subjects in the high JDL condition also perceived greater JDL than subjects in the other experimental conditions. The pattern of findings from these analyses indicates that when task complexity was high, high job decision latitude reduced the perception of task complexity relative to when job decision latitude was low. Increasing JDL can reduce the perceived demands of high task complexity (Karasek, 1979). The availability of a high degree of individual control over heavy work demands seems to cushion the perceived and the felt effects of those demands. The opportunity to make decisions about work activity appears to enhance workers' feelings of competence, worth, and skill-utilization in work. The provision of
considerable JDL is clearly a psychologically-desirable feature of work. In the present experiment, this was achieved at the expense of productivity. An important question awaiting field research is whether such a decrease in productivity is a durable or transient phenomenon.

**Work Preferences: Hypothesis 2**

Hypothesis two was an assessment of the relationship between abilities, personality, and preferences for work predicted by congruence theory. Specifically, congruence theory predicted that abilities would be more closely related to preferences for task complexity while personality and attitudes would be more closely related to preferences for autonomy, that is, high JDL. The overall pattern of correlations between ability and personality measures, and work preferences as measured by the Work Aspect Preference Scale (WAPS), failed to support the congruence theory prediction. Only a few significant relationships were observed between abilities, locus of control, and work preferences. A predicted significant correlation between the Internal Control Index (ICI; Dutteiler, 1984) measure of locus of control and WAPS Independence did not emerge. Furthermore, there was no relationship between the subscales of the Multidimensional Aptitude Battery (MAB) and the WAPS subscales of Creativity and Self-Development.

There are several possible explanations for these nonsignificant findings. First, the relationship between
abilities and preferences for task complexity as postulated by Barrett (1978) may be nonexistent. Second, the presence of such a relationship might be difficult to evaluate from questionnaires which do not refer to specific situations that respondents are familiar with, or about which they have accurate stereotypes. Third, it is possible that there may be a restriction of range in the ability and in the work preference measures taken from the somewhat homogeneous sample of university students.

The Congruence Model: Hypothesis 3

The third hypothesis was formulated to directly test Barrett’s (1978) congruence model of the relationship between abilities and task satisfaction as a function of task complexity. According to congruence theory, the relationship between task-relevant abilities and task satisfaction varies as a function of the extent to which the task requires the use of those abilities. Specifically, congruence theory postulates a negative linear relationship between ability and task satisfaction when task complexity is low, and an inverse “u”-shaped relationship between ability and task satisfaction when task complexity is high. The experimental conditions in this study were chosen so as to allow these predictions to be tested. However, no relationship, either linear or curvilinear, was found between abilities and task satisfaction in relation to objective task characteristics.
Both methodological and theoretical explanations may be considered for these findings. Methodologically, there may have been a restriction of range in the variables measured. Among the measured scales, the use of a homogeneous sample of female undergraduate students might have restricted the range of scores on either or both of the ability measures or the postexperimental measures. Yet these variables generally displayed normal distributions with means near their theoretical midpoints, and adequate standard deviations. The theoretical implication of these findings that seems most plausible is that, since abilities predicted objectively measured performance but not affective responses to the task, the congruence hypothesis is not tenable. Past research has indicated inconsistent support for the propositions made by congruence theory (Wall & Payne, 1973; Barrett & O'Connor, 1978; O'Brien & Dowling, 1981). When skill-utilization was defined objectively in this study by measured abilities and experimentally-manipulated task characteristics, there was no evidence to support the congruence hypothesis of a match between abilities and task satisfaction as a function of task complexity. This conclusion leaves unanswered the question of what factors, either objective task characteristics or individual attributes, may account for a substantial part of the variance in perceptual and affective response ratings.
Locus of Control and Work Behaviour: Hypothesis 4(a) and Hypothesis 4(b)

Hypotheses four (a) and four (b) predicted interactions between locus of control and task characteristics for both work performance and work experience. However, there were no interactions between locus of control, as measured by the Internal Control Index and task characteristics in either performance, or affective responses to the work.

There are measurement problems with the ICI which may have precluded adequate assessment of subjects' personal control beliefs. Subjects' scores on the ICI were generally elevated within the range of possible scores, although the experimental sample mean was similar to the mean of the normative sample of university students (Dutteiler, 1984). The influence of social desirability on ICI scores has not yet been investigated. It is unknown to what extent the elevated mean for ICI scores is due to personal control beliefs rather than responding in a socially desirable way. Furthermore, the construct validity still remains to be established. Future research on the relationship between locus of control and work variables should await a more psychometrically-refined measure of locus of control, such as that proposed by O'Brien (1986).

The results of research on the role of locus of control in work behaviour have been mixed. Effects observed in the field are rarely observed in controlled experiments. In spite of this, the idea that personal control beliefs have a
part in the explanation of individual differences in work behaviour continues to have strong intuitive appeal. In future research, it may be fruitful to consider an approach to the measurement of personal control beliefs that is narrow and situationally-specific as opposed to a broad and trait-like approach such as that of the locus of control construct. A promising alternative to locus of control to be considered in the measurement of personal control beliefs is the concept of self-efficacy (Bandura, 1986). It might be particularly useful because of the situational specificity of its microanalytic measurement procedure.

Perceived Task Characteristics, Task Perceptions, and Affective Responses to the Work

Perceptions of task complexity, and perceptions of the work as challenging independently displayed a strong positive association with both the attractiveness of the task and with intrinsic task satisfaction. Furthermore, perceived skill-utilization and perceived freedom in how to do the work were also positively associated with intrinsic task satisfaction, but not with task attractiveness. These correlations are consistent with the expectation by job enrichment theory (Hackman & Oldham, 1980) that the magnitude and direction of correlations between perceptions of task characteristics and task satisfaction should vary across facets of satisfaction. Perceptions of job content showed higher correlations with intrinsic task satisfaction, a facet of job satisfaction that is closely related to job
content than to task attractiveness, which represents a more global appraisal. Both the magnitude and the direction of the observed relationships between perceived task characteristics and intrinsic task satisfaction confirm that high scope in job content is associated with a feeling of competence and mastery in work. Furthermore, these findings provide support for the congruence hypothesis in that the subjective congruence between valued skills—if they were presumably also task-relevant for the subjects—and task demands was associated with positive affective responses to job content.

The pattern of the correlations between perceived task characteristics and affective responses to the work is consistent with Hackman and Oldham's assertion that perceived task characteristics may be more causal of affective responses than objective task characteristics. Clearly in this study, perceptions of task characteristics were more strongly associated with affective responses to the work than were variations in objective task characteristics. However, the direction of causality in the relationship between task perceptions and affective responses to the work can only be assumed. This assumption is reasonable given that most research supports the view that task perceptions cause affective responses to the tasks (Griffin, 1982). It is also plausible, however, that individual differences in task satisfaction may cause people
to perceive task characteristics in different ways (O'Reilly, Parlette, & Bloom, 1980; Griffin, 1982). Either way, nontask variables such as informational cues and leader behaviour, along with interrelationships among the variables involved, may obscure the direction of causality (Griffin, 1982).

Implications of The Study

Job Content in Computer-Based Clerical Work

The principal implication of the present study for computer-based clerical work is that the degree of latitude in making decisions about how to work is an important determinant of how people experience their work. The findings of the present study are clear: When people are able to decide and control how they do their work, they experience lower workload and more positive affective responses, even when the work is very demanding. Personal control in work has been consistently identified as a central element of psychologically-based job design (Hacker, 1981; Kohn & Schooler, 1983; O'Brien, 1980, 1983, 1986).

With specific reference to computer-based clerical work, a sense of personal control of work can be fostered in several ways: Through the participation of users in the selection and implementation of a computer-based work system; in the organization of work that allows the worker or user to regulate his or her responses in relation to task demands (Frese, 1987; Mumford, 1984); and through the
ergonomics of the software (Turner & Karasek, 1984). System designers should also keep in mind a model of the worker/user as active operator. In other words, job decision latitude can be found in control over the work as well as in the controllability of the computer system.

A second implication for the design of computer-based clerical work is the importance of subjective congruence between skill use and task demands. To the extent that people see their work as complex, meaningful, and engaging their valued skills, they are more likely to be satisfied with job content. Like job decision latitude, these factors have also been consistently identified as important determinants of psychological well-being at work (e.g., Hackman & Oldham, 1980; O’Brien, 1980, 1983, 1986). Work design for computer-based clerical work should provide workers with the opportunity to acquire and to develop a variety of skills and knowledge.

**Directions for Future Research**

The results of the present research suggest several lines of investigation.

A methodological difficulty when conducting laboratory research on job design variables is that of a short time span in which to observe and to measure possible task effects. Even in field settings, the effect sizes reported for affective responses to work conditions are usually quite small (see meta-analysis by Stone, 1986). Nonetheless,
small-magnitude effects that are statistically significant may be very meaningful over long periods of time; and they may have important consequences for both the worker and the organization (O’Brien, 1986; Kohn & Schooler, 1983). Future experimental research might consider increasing the range and precision of task manipulations. Further work in the quantification of task characteristics building upon the contributions of O’Brien (1986) and Wood (1986) would be especially helpful in understanding the link between job content and work outcomes, particularly with respect to affective responses. Also, the use of a repeated-measures design strategy, although cumbersome to implement, could provide a more powerful test in the laboratory of the kinds of hypotheses that have been formulated in this study.

The generalizability of the findings concerning workload and affective responses to work still needs to be ascertained. Field experiments which combine a degree of experimental control with precise instrumentation and carefully-defined task constructs would provide practical information for office work system designers. Much of the available research on computer-based clerical work consists of anecdotal case descriptions. Given that the economic, social, and psychological consequences of computerizing office work are enormous and all but inevitable, data from both carefully-controlled experimental and field research on the application of job design principles to computer-based clerical work would be helpful and timely.
Further, questions still remain about the factors—either task characteristics or individual differences—which would account for the variance in task perceptions that could not be explained by the task manipulations or individual differences in this experiment. Any work-related outcome is the result of many factors, of which job design is only one factor (Griffin, 1982). Consequently, the effects of job design should not be dramatic, because work outcomes are influenced by many variables. In particular, the effects of social information processing variables, such as information cues from co-workers and leader influence should be investigated to clarify their role in the process of job design for computer-based clerical work.

Finally, it should be remembered that job design is both a tool and an ideology. The close association of job enrichment with humanistic values ensures its appeal to both those who are genuinely concerned about psychological well-being at work and to those who are not. A criticism of job design is that the real concerns which lead to its promotion are primarily about profitability and about increasing production output (Kelly 1982a, 1982b) and not about people. Job redesign has been attacked as being merely a political tool used to subtly reinforce managerial control (Cherns, 1980). Kelly (1982a, 1982b) has questioned the idea that dissatisfaction with job content leads to a wide range of unpleasant individual and emotional consequences. Instead,
Kelly suggests that an increased awareness of structural conflict in the employment relationship may be beneficial to an increased understanding by both employers and employees of job design and its consequences. A view of the relationship between employer and employee as fundamentally antagonistic rather than cooperative in nature may provide an alternative to conventional approaches based on job content and intrinsic motivation (Kelly, 1982b, p. 49) in the analysis of job design effects. It may be that, as Kelly suggests, the dissociation between performance and attitudes often observed in job redesign interventions can be best understood by combining theoretical perspectives. The type of economic and structural analysis advocated by Kelly might best explain the performance effects of job redesign by focusing attention on the instrumental concerns of employers and employees; while conventional job redesign theory might best explain job attitudes, and in particular, job satisfaction (Kelly, 1982b, p. 49).

In whatever ways jobs are designed, work performance will inevitably alter not only the environment, but also the person who performs the work. The way in which people perform and experience work has an important developmental influence on psychological functioning in adulthood. It affects attitudes and personality, family and social relations, as well as leisure activities (Kohn & Schooler, 1983; Mortimer, Lorence, & Kumka, 1986; O'Brien, 1986). More than any previous technology, the computer has the
potential to transform people's awareness of themselves, of others, and of their relationship with the world—in short, computers offer the vision of a new mind, a "second self" (Turkle, 1984). The conscious consideration of psychologically-based job design in computer-based clerical work can surely contribute to this transformation.
APPENDIX A

PROOFREADING TASK INSTRUCTIONS
(LOW TASK COMPLEXITY, HIGH JOB DECISION LATITUDE CONDITION)

PURPOSE OF TASK

In the following task, you are to make corrections to a report which is on the computer that has typing and spelling mistakes in it. The corrections that you are to make have already been marked on a printed rough draft of the report, which has been placed in the basket marked "PROOFREADING". Take the printed copy out of the basket and find the proofreader’s marks in the report. For each mistake indicated in the rough draft, input the appropriate correction on screen.

PROCEDURE

1. To start the proofreading task, go to the MAIN TASK MENU and select the number for the PROOFREADING option. A new screen will appear, showing the beginning of the report.

2. Enter the corrections on the computer screen as they are indicated on the printed draft. Use the arrow keys to "scroll" through the report. NOTE THAT YOU CAN MOVE DOWN AND SIDEWAYS WITH THE ARROW KEYS. YOU CAN ONLY MOVE UP THROUGH THE PORTION OF TEXT THAT IS CURRENTLY DISPLAYED ON SCREEN.

3. Press <ESC> to return to the main task menu.

Work as fast and as carefully as you comfortably can.
PROOFREADING TASK INSTRUCTIONS
(HIGH TASK COMPLEXITY, HIGH JOB DECISION LATITUDE CONDITION)

PURPOSE

In the following task, you are to proofread a report which which is on the computer that has typing and spelling mistakes in it. Read the report on the computer screen, look for any typing or spelling mistakes that may have been made, and correct the mistakes on the computer screen.

PROCEDURE

1. To start the proofreading task, go to the MAIN TASK MENU and select the number for the PROOFREADING option. A new screen will appear, showing the beginning of the report.

2. Enter the corrections on the computer screen. Use the arrow keys to "scroll" through the report. NOTE THAT YOU CAN MOVE DOWN AND SIDEWAYS WITH THE ARROW KEYS. YOU CAN ONLY MOVE UP THROUGH THE PORTION OF TEXT THAT IS CURRENTLY DISPLAYED ON SCREEN.

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   Work as fast and as carefully as you comfortably can.
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(HIGH TASK COMPLEXITY, LOW JOB DECISION LATITUDE CONDITION)

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PROCEDURE

1. A new screen shows the beginning of the report.

2. Enter the corrections on the computer screen. Use the arrow
keys to "scroll" through the report. NOTE THAT YOU CAN MOVE
DOWN AND SIDEWAYS WITH THE ARROW KEYS. YOU CAN ONLY MOVE UP
THROUGH THE PORTION OF TEXT THAT IS CURRENTLY DISPLAYED ON
SCREEN.

Work as fast and as carefully as you comfortably can.
Intergovernmental relations are critically important in the Canadian political system, and intergovernmental officials are central participants in the conduct of these relations. This report examines the role of these intergovernmental officials. The first part of the report describes the striking growth since the early 1960s in the machinery for intergovernmental liaison. The second part utilizes three models of intergovernmental relations to explain the functions of intergovernmental officials. The third part focuses on the political role of these officials, and the fourth part assesses the extent to which intergovernmental officials are held responsible for the power they exercise in the political system. The primary emphasis of the essay is on federal-provincial administrative liaison, but many of the observations made here are directly relevant to the activities of officials involved in provincial-municipal and interprovincial relations.

It is difficult to distinguish precisely between intergovernmental officials and other public servants. The term is normally used to refer only to so-called intergovernmental affairs specialists. These are senior administrative officials who are engaged solely or primarily in intergovernmental business. They are usually housed in separate departments or other administrative units (for example, central agencies) responsible for the coordination of intergovernmental matters both within their own government and with their governments. But, in varying degrees, many other officials are involved in
APPENDIX B

TEXT ENTRY TASKS
APPENDIX B

TEXT ENTRY TASK: INSTRUCTIONS AND MATERIALS FOR SIMPLE CONDITION

CORRESPONDENCE TASK
INSTRUCTIONS

PURPOSE

In the following task, you are to write five letters and five memos into the computer. As in many offices, you will be working from rough drafts that you are given. This information is in the file on your desk that is labelled "CORRESPONDENCE". Take the information from the basket and look at it. Notice that there are 5 letters and 5 memos to write, and that all are numbered (Letter #1...#5, Memo #1...#5). Each letter and memo comes with all the information you need in order to write it. Your task is to input these composed letters and memos into the computer. Each letter and each memo is considered a separate item.

PROCEDURE

1. From the TASK MENU, press 2 on the keyboard to obtain the "CORRESPONDENCE MENU". Notice that there are 10 selections on the correspondence menu, one for each of the 10 items in this job.

2. To start, select "ITEM NO. 1" on the menu by pressing "1". The new screen is blank, and ready for your work.

3. Input your work for item no. 1.

4. When you have finished item no. 1, return to the correspondence task menu, by pressing the <ESC> key.

5. Proceed to item no. 2 by pressing "2". When you have finished task no. 2, go on to work on the remaining items, in sequence, from no. 3 to no. 10, by repeating steps 3-5 above.

Work as carefully and as fast as you comfortably can.
TEXT ENTRY TASK: INSTRUCTIONS AND MATERIALS FOR COMPLEX CONDITION

CORRESPONDENCE TASK

INSTRUCTIONS

PURPOSE

In the following task, you are to write five letters and five memos into the computer. As in many offices, you will have to compose these letters and memos by using the information that you are given. This information is in the file on your desk that is labelled "CORRESPONDENCE". Take the information from the basket and look at it. Notice that there are 5 letters and 5 memos to write, and that all are numbered (Letter #1...#5, Memo #1...#5). Each letter and memo comes with the information that you will need in order to compose and to type it on the computer screen. You may compose the letters and memos directly on the computer screen or you may use the scratch paper and pencil provided. Input each composed letter and each composed memo into the computer. Use all the information that you think relevant. Each letter and each memo is considered as a separate item.

 Scratch paper and a pencil are available if you need them, and can be found with the material in the file.

PROCEDURE

1. From the main TASK MENU, press 2 on the keyboard to obtain the "CORRESPONDENCE MENU". Notice that there are 10 selections on the correspondence menu, one for each of the 10 items in this job.

2. To start, select "ITEM NO. 1" on the menu by pressing "1". The new screen is blank, and ready for your work.

3. Input your work for item no. 1.

4. When you have finished item no. 1, return to the correspondence task menu, by pressing the "ESC" key.

5. proceed to item no. 2 by pressing "2". When you have finished task no. 2, go on to work on the remaining items, in sequence, from no. 3 to no. 10, by repeating steps 3-5 above.

Work as carefully and as fast as you comfortably can.
November 3, 1988

Nordic Inn
1286 York Meadows Drive
Hamilton, Ont.
K1A 2B7

Dear Sir:

Caldwell Industries is planning a conference on "Recent Developments in Network Distribution Systems" to be held on February 10 to 12, 1989. I would like to enquire about the possibility of holding the conference at the Nordic Inn. Please send me information on the availability and cost of 30 rooms, and a conference room from February 10 to 12, along with a private dining room for dinner meetings on the nights of February 10-11th.

Thank you.

Yours Truly,

Your name
2. (SIMPLE)

DATE: Today's date

TO: Michael Hendrickson
    Comptroller

FROM: Your name

RE: Budget request for computer hardware

Here are the figures you requested on the computer hardware budget for the next fiscal year. I have consulted with the Manager of Information Services and the purchasing supervisor. Both agree that the need for these figures can be justified.

**BUDGET REQUEST FOR COMPUTER HARDWARE**

<table>
<thead>
<tr>
<th>Item</th>
<th>1988 Amount Requested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computers</td>
<td>$44,500</td>
</tr>
<tr>
<td>Terminals</td>
<td>$15,700</td>
</tr>
<tr>
<td>Printers</td>
<td>$12,300</td>
</tr>
<tr>
<td>Modems</td>
<td>$3,200</td>
</tr>
<tr>
<td>Magnetic media</td>
<td>$1,400</td>
</tr>
</tbody>
</table>
November 2, 1988

Robert Rathbone, Purchasing Agent
Wyandotte Inc.
1224 Malden Rd.
Anderdon, Ont.
N4C 5L8

Dear Mr. Rathbone:

After reviewing your financial statements and bank references, we are unable to extend credit on large orders to your firm at the present time. We will be pleased to reconsider your request when your financial position changes. In the meanwhile, we will be happy to serve you on a cash basis.

We hope that you will let us continue to serve you.

Yours Truly,

Your name
4. (SIMPLE) TYPE THE FOLLOWING LETTER

Today's date

Ms. Sandra Ohlsen, Chief Engineer
Bluewater Chemicals
462 Huron Street
Sarnia, Ontario
K1A 0M7

Dear Ms. Ohlsen:

Thank you for your letter of October 27 to Mr. Ken Wallace. Because of the nature of the letter, it has been forwarded to Mr. John Cummings, Manager of Customer Relations. Mr. Cummings will be in touch with you as soon as he returns from an assignment in Manitoba.

Sincerely,

Your name
Mr. David Ziegler  
Washtenaw Inc.  
1352 State Street  
Ann Arbor, MI 31376  
U.S.A.

Dear Mr. Ziegler,

Thank you for your understanding letter of November 4 reporting that 3 of the 17 regulators you ordered were defective when the shipment arrived. I cannot blame you at all for being disappointed and frustrated.

I am sorry that you have been put to so much trouble, but 3 replacement regulators are being sent to you today. I certainly hope that these arrive intact.

We have modified our packaging and are confident that we have eliminated the possible cause of breakage. Again, please accept my apology.

Sincerely,

Your name
6. (SIMPLE) ANSWER AN INFORMATION REQUEST

Today's date

Mr. Raymond Barrett
Allied Resource Management
64630 Sandusky Drive
Cleveland, OH 45382
U.S.A.

Dear Mr. Barrett:

Thank you for your interest in the products of Caldwell Industries. It is our pleasure to enclose the information you requested. Over the past decade, Caldwell Industries has produced thousands of electronic controls for the energy industry. We hope sincerely that our broad experience, technological know-how and extensive mechanized production facilities can be of service to you.

Please let me know if I can be of further assistance.

Sincerely,

Your name
7. (SIMPLE) TYPE THE FOLLOWING MEMO

TO: Helen St. Aubin

FROM: your name

DATE: Today's date

SUBJECT: Leadership Training Course

This will confirm your registration for the Leadership Training Course to be held on December 4, from 9:00 a.m. to 4:00 p.m. in the board room. If you must cancel, let me know immediately (ext. 2206).

In order for you to receive the most benefit from the Course, I recommend that you review your course materials (attached) prior to attending the class.

After you take the course, please submit a completed "Training Evaluation Form" (also attached) and a brief summary of the benefits you derived, deficiencies in the course content, instructor's presentation, and meeting format. Feel free to suggest any improvements in these areas.

If you have other questions about the Leadership Training Course, please ask.
8. (SIMPLE) TYPE THE FOLLOWING MEMO

TO:       Ned Heath
           Maintenance
FROM:     Your name
DATE:     Today's date
SUBJECT:  Air conditioning filter screens

To follow up on our discussion of three weeks ago about the problem of the air-conditioning filter screens, I would like to find out when they will be installed. May I ask you to let me know if you have any problems in the installation process? I am available to be of assistance if you need it.
9. (SIMPLE) MEMO ABOUT PROCEDURE

TO: All computer users

FROM: Your name

DATE: Today's date

SUBJECT: New Procedure for Reporting Computer Failures

Because of the 15 additional computers that have been installed this year, verbal reports of computer failures are no longer adequate for keeping records and making repairs. Therefore, we have established a new procedure for reporting on computer failures. In order to initiate repairs, you must first notify Computer Operations in writing about malfunctions. They will then arrange for the Maintenance Department to provide the required service.
TO: Terri Brock, Accounts Payable
FROM: Your name
DATE: Today's date
SUBJECT: Overpayment on invoice 3417 from Anderdon Supply

The Comptroller has notified me that an overpayment of $1000.00 was made on invoice no. 3417 from Anderdon Supply.

I suggest that you subtract the amount overpaid from Anderdon Supply's next invoice.

Please verify the overpayment and then advise both me and the Comptroller and me about correcting our account records. Please do this as soon as possible.
1. COMPOSE AND TYPE THE FOLLOWING LETTER:

WRITE TO:

Nordic Inn
1286 York Meadows Drive
Hamilton, Ont.
K1A 2B7

INCLUDE THE FOLLOWING INFORMATION IN THE LETTER:

1. Today's date
2. Address of the Nordic Inn
3. Salutation: "Dear...:

4. Caldwell Industries, Inc., is planning a conference on "Research on New Energy Sources." It will be held on February 10 to 12, 1989.

5. Inquire about the availability and cost of 30 single rooms, a conference room, and a private dining room for a dinner meetings on the nights of February 10 and 11.

6. An appropriate closing

7. Your name
2. COMPOSE AND TYPE THE FOLLOWING MEMO:

DATE: today's date

TO: Michael Hendrickson
    Comptroller

FROM: Your name

RE: BUDGET REQUEST FOR COMPUTER HARDWARE

INCLUDE THE FOLLOWING INFORMATION IN THE MEMO:

1. You are sending him the figures he requested on the computer hardware budget for the next fiscal year.

2. You have consulted with the Manager of Information Services as well as the purchasing supervisor. Both agree that these figures can be justified.

3. The following table:

   BUDGET REQUEST FOR COMPUTER HARDWARE

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
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<td>$3,200</td>
</tr>
<tr>
<td>Magnetic media</td>
<td>$1,400</td>
</tr>
</tbody>
</table>
3. COMPOSE AND TYPE THE FOLLOWING LETTER:

WRITE TO:

Robert Rathbone, Purchasing Agent
Wyandotte, Inc.
1224 Malden Road
Anderdon, Ontario
N4C 6L8

INCLUDE THE FOLLOWING INFORMATION IN THE LETTER:

1. Today’s date
2. Full name and address of Wyandotte, Inc.
3. Salutation
4. You have reviewed their financial statements and bank references and you are unable to extend credit to their firm at the present time.
5. Let the customer know that you will be glad to supply them on a cash basis only until their financial position changes.
6. Make a tactful closing by inviting the customer back to us.
7. Your name
4. **COMPOSE AND TYPE THE FOLLOWING LETTER:**

**WRITE TO:**

Sandra Ohlsen, Chief Engineer  
Bluewater Chemicals  
462 Huron Street  
Sarnia, Ontario  
K1A OM7

**INCLUDE THE FOLLOWING INFORMATION IN THE LETTER:**

1. Today’s date
2. Name and address of Bluewater Chemicals, above
3. Salutation
4. Thank her for her letter of July 29 to Mr. Ken Wallace.
5. Because of the nature of the letter, it has been forwarded to Mr. John Cummings, Manager of Customer Relations.
6. Mr. Cummings will be in touch with her as soon as he returns from an assignment in Manitoba.
7. Closing
8. Your name
5. COMPOSE AND TYPE THE FOLLOWING LETTER:

WRITE TO:

David Ziegler
Washtenaw, Inc.
1352 State Street
Ann Arbor, MI 31376
U.S.A.

INCLUDE THE FOLLOWING INFORMATION IN THE LETTER:

1. Today's date
2. Name and address above
3. Salutation
4. Thank him for his understanding letter of July 28, in which he reported that 3 of the 17 regulators he ordered were defective when the shipment arrived.
5. You cannot blame him for being frustrated and disappointed.
6. You are sorry that he has been put to so much trouble, but 3 replacement regulators are being shipped to him today.
7. You hope that they will arrive intact.
8. You have modified the packaging and are confident that you have eliminated the possible cause of the breakage.
9. Closing
10. Your name
6. COMPOSE AND TYPE THE FOLLOWING LETTER:

WRITE TO:

    Raymond Barrett  
    Allied Resource Management
    64630 Sandusky Drive
    Cleveland, OH 45382
    U.S.A.

INCLUDE THE FOLLOWING INFORMATION IN THE LETTER:

1. Today's date
2. Name and address above
3. Salutation
4. Thank him for his interest in the products of Caldwell Industries.
5. It is your pleasure to enclose the information he requested.
6. Over the past decade, Caldwell Industries has produced thousands of electronic controls for the energy industry.
7. You sincerely hope that Caldwell's broad experience, technological know-how, and extensive mechanized facilities can be of service to him.
8. Tell him to please let you know if you can be of further service.
9. Closing
10. Your name
7. COMPOSE AND WRITE THE FOLLOWING MEMO:

TO: Helen st. Aubin
FROM: Your name
DATE: Today's date
SUBJECT: LEADERSHIP TRAINING COURSE

INCLUDE THE FOLLOWING INFORMATION IN THE MEMO:

1. The memo will confirm her registration for the Leadership Training Course, to be held on December 4, from 9:00 a.m. to 4:00 p.m., in the board room.

2. If she must cancel, she should let you know immediately (at ext. 2206).

3. In order for her to receive the most benefit from the Leadership Training Course, you recommend that that she review her course materials prior to attending the Course.

4. After she takes the Course, ask her to please submit a brief summary of the benefits she derived from the Course, and an evaluation of the Course content, instructor's presentation, and meeting format.
3. COMPOSE AND TYPE THE FOLLOWING MEMO:

TO:         Ned Heath, Maintenance
FROM:       Your name
DATE:       Today's date
SUBJECT:    AIR CONDITIONING FILTER SCREENS

INCLUDE THE FOLLOWING INFORMATION IN THE MEMO:

1. To follow up on your discussion with him of three weeks ago about the problem of the air conditioner filter screens, you would like to find out when they will be installed.

2. Ask him to let you know if he has any problems in the installation process.

3. You are available to be of assistance if he needs it.
9. COMPOSE AND TYPE THE FOLLOWING MEMO:

TO: All computer users
FROM: your name
DATE: Today’s date
SUBJECT: NEW PROCEDURE FOR REPORTING COMPUTER FAILURES

INCLUDE THE FOLLOWING INFORMATION IN THE MEMO:

1. Because of the 15 additional computers that have been installed this year, verbal reports of computer failure are no longer adequate for keeping records and making repairs.

2. Therefore, you have established a new procedure for reporting failures.

3. In order to initiate repairs, users must first notify Computer Operations in writing about malfunctions.

4. Computer Operations will then arrange for the Maintenance Department to provide the required service.
10. COMPOSE AND TYPE THE FOLLOWING MEMO:

TO: Terri Brock, Accounts Payable
FROM: Your name
DATE: Today's date
SUBJECT: OVERPAYMENT ON INVOICE 3417 FROM ANDERDON SUPPLY

INCLUDE THE FOLLOWING INFORMATION IN THE MEMO:

1. The Comptroller has notified you that an overpayment of $1000.00 was made on invoice no. 3417 from Anderdon Supply.

2. Suggest that she subtract the amount overpaid from Anderdon Supply's next invoice.

3. Ask her to please verify the overpayment and then advise both you and the Comptroller about correcting our account records.

4. She should do this as soon as possible.
APPENDIX C

DATA ENTRY TASKS
APPENDIX C

DATA ENTRY TASK; LOW TASK COMPLEXITY CONDITION

ACCOUNTING TASK

PURPOSE

In this task, you are to enter into the computer records of the financial transactions of Caldwell Industries conducted during the month of March, 1988.

In the file which is labelled "ACCOUNTING", you will find the records of financial transactions that you are to input into the computer. A transaction is an exchange of values: something is given and something is received. There are 2 different kinds of transaction records: cheques, and invoices.

These records have been sorted into bundles, such that each bundle contains a different type of transaction record. Thus, there are 5 types of transactions at Caldwell Industries, which are listed on the left column of the A/B RULE TABLE (see attached). Notice that the records in each bundle have already been placed in chronological order, from the beginning of the month on top, to the end of the month on the bottom.

In each bundle, the transactions should be recorded in the A ACCOUNT and the B ACCOUNT that are indicated on the attached labels. Keep in mind that a transaction is a value given in exchange for a value received. Because of this, each transaction is recorded in the A ACCOUNT for the value received and the B ACCOUNT for the value given. You should always enter all the records of each transaction type in the same 2 accounts. For example, all the transactions in the "SALES-CASH" bundle are to be entered in both the "CASH-RECEIVED" and the "SALES" accounts.
DATA ENTRY TASK: HIGH COMPLEXITY CONDITION

ACCOUNTING TASK

PURPOSE

In this task, you are to enter into the computer records of the financial transactions of Caldwell Industries conducted during the month of March, 1988.

In the file which is labelled "ACCOUNTING", you will find the records of financial transactions that you are to input into the computer: these are either invoices or cheques. A transaction is an exchange of values: something is given in return for something that is received. Because of this, each transaction is recorded into an account for the value received and an account for the value given. There are 5 types of transactions at Caldwell Industries, which are listed in the left column of the A/B RULE TABLE (see attached).

1. First, you must analyze each transaction record, using the information on the invoice or cheque, and the right-hand column of the A/B RULE TABLE as a reference, to identify which of the 5 types of transaction it is. Then, look at the corresponding 2 accounts on the computer into which the transaction should be recorded: these accounts are listed in the middle and left columns next to each transaction type.

2. Enter each transaction record into the appropriate 2 accounts on the computer, using the number indicated for each account on the right side of the accounting screen. You should always enter all the records of each transaction type in the same 2 accounts. For example, all the "SALES-CASH" transactions are to be entered in both the "CASH-RECEIVED" and the "SALES" accounts.
DATA ENTRY TASK INSTRUCTIONS FOR HIGH JOB DECISION LATITUDE COND.

PROCEDURE

1. On the TASK MENU, enter the number "3" to display the Accounting screen. Notice that the screen is split in two. The left side of the screen is the area where you are to enter the transaction data. There are spaces to fill in for the name, date, number, account number, and the amount of the transaction. The right side of the screen shows the names of the accounts and their corresponding computer numbers.

2. Take the "SALES-CASH" transactions. Now, look at the A/B RULE TABLE that is attached. The A/B RULE TABLE shows that SALES-CASH TRANSACTIONS should be entered in the "CASH-RECEIVED" account, which is listed as account no. 1 on the right side of the screen, and should also be entered in the "SALES" account, which is listed as account no. 2 on the right side of the screen.

3. TO MAKE AN ENTRY ON THE COMPUTER, TAKE A TRANSACTION RECORD, AND DO THE FOLLOWING STEPS ON THE COMPUTER SCREEN:

(1) Type in the NAME of the business, then type <ENTER>.
(2) Type in the TRANSACTION NUMBER, then type <ENTER>.
(3) Type in the TRANSACTION DATE, then type <ENTER>.
(4) Type in the A ACCOUNT NUMBER, from the right side of the screen, then type <ENTER>.
(5) Type in the AMOUNT, then type <ENTER>.
(6) Type in the B ACCOUNT NUMBER, from the right side of the screen, then type <ENTER>.
(7) Your entry is now complete. Press <ESC> to clear the screen for the next entry.

Work as fast and as carefully as you comfortably can.
DATA ENTRY TASK: TRANSACTIONS
TRANSACTIONS DURING MONTH OF MARCH, 1988

1. CASH SALES

DATE DETAILS

02 $6,545.00 cash from Milton & Lawson for sale of heat exchanger, invoice 29226.
07 Received $9,110.43 from cash sales, invoice 12282.
14 Received $6,594.00 from cash sales for week, invoice 51745.
16 Invoice no. 75362, sale of conversion unit to Weldon Mfg., for $9255.00, paid in cash.
17 Invoice no. 08652, sale of thermostat interface to Banner Co., $376.28 cash.
21 Received $5,726.08 from cash sales for the week, invoice 10395.
25 Sold roof unit to Newman Container Co., invoice no. 05485, $11,733.05
30 Received $8,755.28 from cash sales for the week, invoice no. 61741.
30 $1,757.50 cash from Ellerbee, Inc. for sale of master controller board, invoice 74345.
30 $6,283.21 cash from Novoflex Corp. for sale of compressor and heat exchange pump, invoice 55615.

2. CREDIT SALES

06 Sale of merchandise to Farmer and Gray, Invoice no. 99943, $8,225.29.
08 Sale of conversion unit to Wellfleet Corp., $3,675.43, invoice no. 24893.
09 Sold merchandise on account to Milano Inc., invoice no. 87021, $7,315.00
12 Sold merchandise to Rhine Manufacturing, invoice no. 29722, $34,281.62.
14 Sold heat exchanger to Cleveland Marine, invoice no. 77742, $17,524.88.
18 Invoice no. 11080, sale of compressors to Midvale Distributors, $14,925.37.
18 Invoice no. 42271, to Stanton Products Co., $6,755.13.
19 Invoice no. 69734 to Rhine Mfg, $18,422.03, for sale of heat pumps.
24 Sold ventilation system to Banner, invoice no. 58500, $12,696.00.
27 Sold thermal conversion unit to Canton, Inc. for $23,581.69, invoice 38873.

3. ASSET PURCHASE-CASH
05 $5488.00 cash to Businessland for HP LaserJet printer, receipt no. 72232.
06 Purchased shop equipment from Windsor Factory Supply, invoice no. 91447, $2,870.41.
07 Purchased sheetstock from Young Supply Co., bill no. 03049, $1,085.76.
08 Purchased facsimile machine from Litton Business Systems, $1803.00, invoice no. 09836.
14 Purchased 10 Makita drills from Tool World, @ $115 ea., $1150.00, invoice no. 59948.
18 Purchased electric pencil sharpener, $74.00, Ace Office Supply, invoice no. 54411.
19 Purchased belt sander from Tool World, $216.79, invoice no. 62612.
24 Purchased electrical testing equipment from Electrozad, $543.66, invoice no. 69361.
27 Purchased 15 trash cans @ 13.88 ea., $208.20, from Canadian Tire, invoice no. 12273.
30 Purchased 2 welding tanks from Lincoln Electric, $340.00, invoice no. 42334.

4. ASSET PURCHASE-CHARGE
03 Purchased painting booth from Lincoln Electric, $26,927.02, invoice no. 46944.
05 Purchased paint sprayer from Promaster, $5934.79, invoice no. 42575.
09 Purchased PBX from Mitel, $6,963.55, invoice no. 63272.
13 Purchased keyless entry electronic system from ADT, $2300.00, invoice no. 46600.
15 Purchased vacuum injection molding machine from MOBAY, $44,300.00, invoice no. 70172.

19 Purchased electronic photocopier from Xerox, $8179.30, invoice no. 48680.

25 Purchased CAD printer/plotter from Alpha Instruments, $5080.00, invoice no. 81395.

25 Purchased 3 computer terminals from Wyse, @ 1299 ea., $3897.00, invoice no. 85187.

27 Purchased drill press from Windsor Factory Supply, $1,900.00, invoice no. 38263.

30 Purchased portable generator from C.O.M.B., $699.00, invoice no. 01710.

5. INVENTORY PURCHASE—CASH

01 $220.50 cash for purchases of gas and oil, Keystone Shell, receipt no. 17903.

05 Purchase of plywood, Beaver Lumber, $518.67, bill no. 93527.

09 Purchased tubing from McKay Co., for $13,300.00 cash, bill no. 21324.

12 Purchased tooling from Lavalin, $3,283.50 cash, invoice no. 87341.

15 Purchased fire extinguishers from Safety Supply, $325.00 cash invoice no. 45181.

18 Purchased pallets from Palco, $398.83 cash, invoice no 49033.

22 Purchased copper tubes, $246.00, from Farina Metalworks, invoice no. 00277.


28 10 Relays, $110.00 cash, Electrozd, invoice no. 78620.

29 Freon, $762.00 from Dupont Chemical Supply, invoice no. 98803.

6. INVENTORY PURCHASE—CHARGE

04 Purchased materials from Hanover Inc., for $6,041.78, invoice no. 45497.

07 Purchased merchandise from Taylor Machinery Co., invoice for $8,027.84, no. 37852.
09  Purchase of office supplies, $343.69, Ace Office Supply, invoice no. 73147.

12  Purchase of welding supplies, $477.53, Lincoln Electric, invoice no. 83474.

12  Purchased electrical motors from Hanover Inc., $4,200.03, invoice no. 03923.

15  Purchased washing machinery from Taylor Machinery Co., $4,793.21, invoice no. 14513.

19  Purchased mesh screening roll, $1,200.00, US Steel, invoice no. 89181.

25  Purchased compressor housings, 35 x $40 ea., $1,400.00 AAF, invoice no. 32167.

28  Purchased 1/2 hp. motors, 30 x 85 ea., $2,580.00 General Electric, invoice no. 41419.

29  Purchased solar panels, 25 x $200 ea., $5,000.00, from Enervert, invoice no. 92598.

7. EXPENSE PAYMENT—CASH

  03     $133.06 cash, in payment of miscellaneous selling expenses, stub no. 44370.

  05     Payment of freight charges to Bondy transport, $338.92, invoice no. 60770.

  06     $5,302.50 for payment on loan, Royal Bank, statement no. 18885.

  11     Payment of biweekly salaries, $11,248.37, stub no. 95977.

  11     Payment of loading dock repairs, $139.48, Rino Construction invoice no. 39828.

  15     Payment of Feb. Freon bill, Dupont Chemical, $729.40, invoice no. 32736.

  18     Mechanical repair, $92.28, Keystone Shell, invoice no. 22844.

  19     Electrical bill, $472.29, Ontario Hydro, Account no. 69694.

  24     Phone bill, $809.63, Bell Canada, Account no. 34176.

  27     Plumbing repair, $167.00, Crane, invoice no. 97147.
8. EXPENSE PAYMENT-CHARGE

06 $107.75 for freight on shipment of tubing from Diamond Inc., invoice no. 51396.

07 $227.29 to Claude Neon, for use of billboard, invoice 61072.

10 $1,155.00 in payment of 1 year insurance policy, Pilot Insurance, account no. 74153.

14 $6643.00 to Taylor Machinery Co., in payment of invoice no. 43826.

15 $1803.61 for lease of trucks, Penske, invoice no. 06081.

18 Employment ad in globe and mail, $117.50, invoice no. 86584.

22 Repairs to roof, G & S Roofing, $3,368.00, invoice no. 73158.

24 Accountant’s fee, Prat & Lamarre, $175.00, invoice no. 65929.

25 Shipping expenses, Maris Transport, $487.00, invoice no. 95847.

30 Painting, $300.00, college Pro Painters, invoice no. 04676.

9. RECEIVED ON ACCOUNTS

01 check for $1,818.24 from Barker Ventilation, in payment of invoice no. 03462.

05 Check for $6,320.12 cash from Newman Container in payment of invoice no. 84994.

06 Check from Cross Co. for $6,517.30, in payment of invoice no. 46058.

10 Check for $6,484.10 From Milton & Lawson, re invoice 79369.

13 Check for $5,316.90 from Broyhill Inc. in payment of invoice no. 47619.

18 Check from Milano Inc., for invoice 91936, for $7,315.84.

20 Check from Farmer and Gray for $3,500.00 in payment of invoice 31243.

21 Received check for $37,095.00 from Rhine Mfg. in payment of invoice no. 98046.

23 Received check from Cleveland Marine for $17,584.88 in payment of invoice no. 97992.

27 Received check from Stanton Co., $6,083.99 in payment of invoice no. 59160.
ACCOUNTING A/B RULE TABLE

<table>
<thead>
<tr>
<th>TYPE OF TRANSACTION</th>
<th>IN ACCOUNT</th>
<th>OUT ACCOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SALES-CASH</td>
<td>CASH-RECEIVED</td>
<td>SALES</td>
</tr>
<tr>
<td>2. SALES-CREDIT</td>
<td>ACCOUNTS RECEIVABLE</td>
<td>SALES RECEIVABLE</td>
</tr>
<tr>
<td>3. PURCHASES-CASH</td>
<td>PURCHASES</td>
<td>CASH PAID OUT</td>
</tr>
<tr>
<td>4. PURCHASE-CREDIT</td>
<td>PURCHASES</td>
<td>ACCOUNTS PAYABLE-PAYABLE</td>
</tr>
<tr>
<td>5. RECEIVED ON ACCOUNTS</td>
<td>CASH-RECEIVED</td>
<td>ACCOUNTS RECEIVABLE COLLECTED</td>
</tr>
</tbody>
</table>

THIS IS AN INVOICE:

<table>
<thead>
<tr>
<th>(INVOICE)</th>
</tr>
</thead>
</table>

INVOICE

No. ________

Date ________

Sold to: _____________________________

Terms: Cash Credit

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Price</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

THE A/B RULE TABLE TELLS YOU INTO WHICH 2 ACCOUNTS EACH TYPE OF TRANSACTION SHOULD BE RECORDED ON THE COMPUTER.

<table>
<thead>
<tr>
<th>TYPE OF TRANSACTION</th>
<th>IN ACCOUNT</th>
<th>OUT ACCOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SALES-CASH</td>
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<td>SALES RECEIVABLE</td>
</tr>
<tr>
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<td>PURCHASES</td>
<td>CASH PAID OUT</td>
</tr>
<tr>
<td>4. PURCHASE-CREDIT</td>
<td>PURCHASES</td>
<td>ACCOUNTS PAYABLE-PAYABLE</td>
</tr>
<tr>
<td>5. RECEIVED ON ACCOUNTS</td>
<td>CASH-RECEIVED</td>
<td>ACCOUNTS RECEIVABLE COLLECTED</td>
</tr>
</tbody>
</table>
THE ACCOUNTING SCREEN LOOK LIKE THIS:

<table>
<thead>
<tr>
<th>Name</th>
<th>Transaction No</th>
<th>Account No</th>
<th>Amount $</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Chart of Accounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Received ...... 1</td>
</tr>
<tr>
<td>Sales ............... 2</td>
</tr>
<tr>
<td>Accounts Receivable- Receivable ...... 3</td>
</tr>
<tr>
<td>Purchases .......... 4</td>
</tr>
<tr>
<td>Cash Paid Out ...... 5</td>
</tr>
<tr>
<td>Accounts Payable ... 6</td>
</tr>
<tr>
<td>Accounts Receivable- Collected ........ 7</td>
</tr>
</tbody>
</table>

A/B RULE TABLE

<table>
<thead>
<tr>
<th>TYPE OF TRANSACTION</th>
<th>IN ACCOUNT</th>
<th>OUT ACCOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SALES-CASH</td>
<td>CASH-RECEIVED</td>
<td>SALES</td>
</tr>
<tr>
<td>2. SALES-CREDIT</td>
<td>ACCOUNTS RECEIVABLE- RECEIVABLE</td>
<td>SALES</td>
</tr>
<tr>
<td>3. PURCHASES-CASH</td>
<td>PURCHASES</td>
<td>CASH PAID OUT</td>
</tr>
<tr>
<td>4. PURCHASE-CREDIT</td>
<td>PURCHASES</td>
<td>ACCOUNTS PAYABLE-PAYABLE</td>
</tr>
<tr>
<td>5. RECEIVED ON ACCOUNTS</td>
<td>CASH-RECEIVED</td>
<td>ACCOUNTS RECEIVABLE COLLECTED</td>
</tr>
</tbody>
</table>
APPENDIX D

DEMOGRAPHIC BACKGROUND QUESTIONNAIRE
APPENDIX L
OFFICE WORK STUDY
PERSONAL INFORMATION QUESTIONNAIRE

PLEASE CIRCLE THE APPROPRIATE ANSWER:

1. What year are you registered in?
   A. First year or preliminary   D. Fourth-year Honours
   B. Second year               E. Graduate student
   C. Third year

2. What would you estimate your typing speed to be?
   A. 0-10 wpm   B. 11-20 wpm   C. 21-30 wpm
   D. 31-40 wpm   E. 41-50 wpm   F. 51+ wpm

3. Have you ever worked in an office?   A. Yes   B. No
   If yes, then please describe:
   The type of work: ________________________________

   ________________________________

   How long: ________________________________

7. Age: ____ years  ____ months

8. How long have you lived in Canada?  ____ years

9. Do you need glasses or contact lenses?
   A. No     B. Yes     C. Don’t know
   If "no",
   A. Vision is already corrected by glasses or contact lenses
   B. Excellent vision: no need for correction
   C. Other (please specify): ________________________________

   If "yes", circle one of the following:
   A. Need to get correction for seeing things close by
   B. Need to get correction for seeing things at a distance
   C. Need to get correction for seeing things both near and far
   D. Other (please specify): ________________________________

PLEASE TURN THE PAGE
10. How much experience do you have with computers?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>Slightly</td>
<td>Moderately</td>
<td>Quite a bit</td>
<td>Very much</td>
<td></td>
</tr>
</tbody>
</table>

Answer the following question only if you have used computers:

11. How much do you enjoy computers?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Moderately</td>
<td>Quite a bit</td>
<td>Very much</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

INTERNAL CONTROL INDEX
INDEX INSTRUCTIONS

Please read each statement. Where there is a blank ____,
decide what your normal or usual attitude, feeling, or behaviour
would be:

<table>
<thead>
<tr>
<th></th>
<th>(A) RARELY (Less than 10% of the time)</th>
<th>(B) OCCASIONALLY (About 30% of the time)</th>
<th>(C) SOMETIMES (About half of the time)</th>
<th>(D) FREQUENTLY (about 70% of the time)</th>
<th>(E) USUALLY (More than 90% of the time)</th>
</tr>
</thead>
</table>

Of course, there are always unusual situations in which this would
not be the case, but think of what you would do or feel in most
normal situations.

Write the letter that describes your usual attitude or behaviour
in the space provided.

1. When faced with a problem I ____ try to forget it.
2. I ____ need frequent encouragement from others for me to
   keep working at a difficult task.
3. I ____ like jobs where I can make decisions and be
   responsible for my own work.
4. I ____ change my opinion when someone I admire disagrees
   with me.
5. If I want something I ____ work hard to get it.
6. I ____ prefer to learn the facts about something from
   someone else rather than have to dig them out for myself.
7. I will ____ will accept jobs that require me to supervise
   others.
8. I ____ have hard time saying no when someone tries to sell
   me something I don’t want.
9. I ____ like to have a say in any decisions made by any group
   I’m in.
10. I ____ consider the different sides of an issue before
    making any decisions.
11. What other people think ____ has a great influence on my
    behaviour.
<table>
<thead>
<tr>
<th>(A) Rarely</th>
<th>(B) Occasionally</th>
<th>(C) Sometimes</th>
<th>(D) Frequently</th>
<th>(E) Usually</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Less than 10% of the time)</td>
<td>(About 30% of the time)</td>
<td>(About half the time)</td>
<td>(About 70% of the time)</td>
<td>(More than 90% of the time)</td>
</tr>
</tbody>
</table>

12. Whenever something good happens to me I _____ feel it is because I've earned it.

13. I _____ enjoy being in a position of leadership.

14. I _____ need someone else to praise my work before I am satisfied with what I've done.

15. I am _____ sure enough of my opinions to try and influence others.

16. When something is going to affect me I _____ learn as much about it as I can.

17. I _____ decide to do things on the spur of the moment.

18. For me, knowing I've done something well is _____ more important than being praised by someone else.

19. I _____ let other peoples' demands keep me from doing things I want to do.

20. I _____ stick to my opinions when someone disagrees with me.

21. I _____ do what I feel like doing not what other people think I ought to do.

22. I _____ get discouraged when doing something that takes a long time to achieve results.

23. When part of a group I _____ prefer to let other people make all the decisions.

24. When I have a problem I _____ follow the advice of friends or relatives.

25. I _____ enjoy trying to do difficult tasks more than I enjoy trying to do easy tasks.

26. I _____ prefer situations where I can depend on someone else's ability rather than my own.

27. Having someone important tell me I did a good job is _____ more important than feeling I've done a good job.

28. When I'm involved in something I _____ try to find out all I can about what is going on even when someone else is in charge.
I.C.I. SCORING

REVERSE SCORING:

The "Rarely" response is scored as 5 points on the following items:

1
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For the remaining items, the response "Usually" is scored as 5 points:

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APPENDIX F

WORK ASPECT PREFERENCE SCALE
WORK ASPECT PREFERENCE SCALE

INTRODUCTION

Different people are attracted to different aspects of work. This scale lists some aspects of work that people consider important. You have to consider which of these aspects of work you prefer. When doing this scale, it does not matter whether you are working or not; you just have to indicate your personal preference.

Each of the aspects of work can be rated in the following way.

1 means Totally unimportant - this work aspect doesn’t matter to me at all and/or I wouldn’t care if a job had this quality or not.

2 means Of little importance - this work aspect is not very important to me and/or I would like a job only a little more if it had this quality.

3 means Moderately important - this work aspect is reasonably important to me and/or I would prefer a job with this quality.

4 means Quite important - this work aspect is very desirable and/or I would look for a job with this quality.

5 means Extremely important - this work aspect is essential to me and/or a job must have this quality for me to be happy with it.

EXAMPLE

Work in which you...

...gain rapid promotions...

There are no right or wrong answers to any of the items, so just indicate what you think of each aspect. Judge each aspect of work by itself. Do not compare one answer with others you have already made. Work as quickly and as carefully as you can. Do not spend too much time on any one item. A little thought each time should be sufficient. Do not leave out any items. If you make a mistake or if you change your mind about an answer, rub it out thoroughly and mark the new number space on the Answer Sheet.

Work in which you........

1. ...can work as fast or as slowly as you like...
2  ...have pleasant people to work with...
3  ...improve the skills you have...
are paid a high salary...
design new things...
know that other people think your work is important
are free to live wherever you like...
are certain of keeping your job...
help build a better society...
are not required to do work in your spare time...
plan and arrange the work of others...
do your job in a safe workplace...
work hard physically...
get to know your fellow workers quite well...
add to the abilities you already have...
can do your own work in your own way...
originate new ideas and/or products...
receive more than your normal pay for good work...
do not have to change the way you live...
get a good reputation for your good work...
give aid to those in need...
can be sure you will always have a job...
set goals for workers to reach...
can forget the work while you are not there doing it...
do not have to spend all your time behind a desk...
do your job in a physically attractive environment...
are always increasing your knowledge...
can start and finish your work when you like...
are really liked by your fellow workers...
become quite wealthy...
experiment with different ways of doing things...
are looked up by other people in society...
are not expected to move wherever the organization wants to put you...
certain your job will last...
help others lead a fuller life...
do not have to think about work once you leave the workplace...
have authority over others...
can work in a pleasant area of town or countryside...
are not just sitting down all day...
determine the way your work is done...
enjoy the company of the people you work with...
can acquire specialized skills...
use ideas, materials to develop new ideas, materials...
receive enough pay to live well...
do not have to change where you live to gain promotion...
can obtain a high status in the eye of others...
make an important contribution to the community...
have a secure future...
set out the best way for others to do a job...
are not expected to take work home...
are physically active...
have a workplace that is clean and tidy...
Check your answer sheet to make sure that have not left out any answers.
APPENDIX G

MICHIGAN ORGANIZATIONAL ASSESSMENT QUESTIONNAIRE
APPENDIX G--MINNESOTA ORGANIZATIONAL ASSESSMENT QUESTIONNAIRE

OFFICE WORK SURVEY

Please rate the office work you have done by circling the response that best describes your reaction to each of the following statements:

MOAQ Variety

12. I get to do a number of different things on my job

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<tbody>
<tr>
<td>Agree or Disagree</td>
<td>Strongly Disagree</td>
<td>Slightly Disagree</td>
<td>Neither Agree</td>
<td>Slightly Agree</td>
<td>Agree Disagree</td>
<td>Strongly Agree</td>
<td>Disagree</td>
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15. My job requires that I do the same thing over and over

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<td>Slightly Agree</td>
<td>Agree Agree</td>
<td>Strongly Agree</td>
<td>Disagree</td>
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18. How much variety is there in your job?

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</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Very little; I do pretty much the same things over and over, using the same equipment and procedures almost all the time.</td>
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<tr>
<td>(4)</td>
<td>Moderate variety.</td>
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<tr>
<td>(7)</td>
<td>Very much; I do many things; using a variety of equipment and procedures.</td>
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MOAQ Freedom

20. How much freedom do you have on your job? That is, how much do you decide on your own what you are going to do?

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<tbody>
<tr>
<td>(1)</td>
<td>Very little; there are few decisions about my job which I can make by myself;</td>
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<tr>
<td>(4)</td>
<td>A moderate amount; I have responsibility for deciding some of the things I do, but not others;</td>
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<tr>
<td>(7)</td>
<td>Very much; there are many decisions about my job which I can make by myself.</td>
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30. It is basically my responsibility to decide how my work gets done

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<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Slightly Disagree</td>
<td>Neither</td>
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<td>Strongly Agree</td>
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<tr>
<td>Agree</td>
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<td>or</td>
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35. I have the freedom to decide what I do on my job

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<tr>
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MOAQ Pace Control

4. My job allows me to control my own work pace

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<td>Strongly Agree</td>
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<td>Agree</td>
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13. I determine the speed at which I work

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26. How much control do you have in setting the pace of your work?

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<tbody>
<tr>
<td>(1) Very little; pace is predetermined and I must work at a strict pace set by someone or something else.</td>
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<tr>
<td>(4) Moderate control of work pace.</td>
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<tr>
<td>(7) A great deal; I determine my own work pace.</td>
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Training Adequacy (manipulation check: one item adapted from MOAQ)

14. I have had enough training to do my job

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<td>Agree</td>
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Task Feedback (manipulation check: one item adapted from MOAQ)

23. As I do my job, I can tell how well I am performing

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MOAQ uncertainty

1. I often have to deal with new problems on the job

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<td>Slightly Agree</td>
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10. On my job, I often have to handle surprising or unpredictable situations

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<td>Neither</td>
<td>Slightly Agree</td>
<td>Agree</td>
<td>Strongly Agree</td>
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25. How much certainty is there in your job?

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<td></td>
<td>(1) Very little; I almost always know what to expect and am never surprised by something happening unexpectedly on my job.</td>
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<tr>
<td></td>
<td>(4) Moderate uncertainty.</td>
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<tr>
<td></td>
<td>(7) A great deal; I am almost never sure what is going to happen, and unexpected things frequently happen.</td>
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**Psychological States**

**MOAQ Challenge**

22. How much challenge is there on your job?

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<tbody>
<tr>
<td>(1)</td>
<td>There is little challenge on my job; I don't get a chance to use any special skills and I never have jobs which require all my skills to complete them successfully.</td>
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<tr>
<td>(4)</td>
<td>Moderate challenge.</td>
<td></td>
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<tr>
<td>(7)</td>
<td>There is a great deal of challenge on the job; I get a chance to use my special skills and abilities and often have jobs which require all my abilities to complete successfully.</td>
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31. To be successful on my job requires all my skill and ability

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<tr>
<td>Disagree</td>
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41. On my job, I seldom get a chance to use my special skills and abilities

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<td>Disagree</td>
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43. My job is very challenging

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<tr>
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MOAQ Meaningfulness

29. The work I do on my job is meaningful to me

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<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Slightly Disagree</td>
<td>Neither Agree or Slightly Agree</td>
<td>Agree or Slightly Agree</td>
<td>Strongly Agree</td>
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36. I feel that most of the things I do on my job are meaningless (R)

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<td>Strongly Agree</td>
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MOAQ Responsibility

39. I feel personally responsible for the work I do on my job

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<td>Agree or Slightly Agree</td>
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44. I deserve credit or blame for how well my work gets done

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<td>Strongly Agree</td>
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MOAQ Intrinsic Rewards Satisfaction

1. How satisfied are you with the chances you have to learn new things?

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<tbody>
<tr>
<td>Very Dissatisfied</td>
<td>Slightly Dissatisfied</td>
<td>Neither Slightly Satisfied or Very Diss.</td>
<td>Slightly Satisfied</td>
<td>Very Satisfied</td>
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</table>
2. How satisfied are you with the chances you have to accomplish something worthwhile?

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</table>
| Very Dissatisfied | Slightly Dissatisfied | Neither | Slightly Satisfied | Very Satisfied or Sat.

3. How satisfied are you with the chances you have to do something that makes you feel good about yourself as a person?

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</thead>
</table>
| Very Dissatisfied | Slightly Dissatisfied | Neither | Slightly Satisfied | Very Satisfied or Sat.

Adaptation of MOAQ pay satisfaction

1. I am very happy with the number of credit points I earned in this experiment

<table>
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<tr>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
| Strongly Disagree | Slightly Disagree | Neither | Slightly Agree | Strongly Agree or Disagree

2. Considering my skills and the effort I put into my work, I am very satisfied with my credit points in this experiment

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</tr>
</thead>
</table>
| Strongly Disagree | Slightly Disagree | Neither | Slightly Agree | Strongly Agree or Disagree

3. How satisfied are you with the credit points you get in this experiment?

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<th>7</th>
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</table>
| Very Dissatisfied | Slightly Dissatisfied | Neither | Slightly Satisfied | Very Satisfied or Sat.

APPENDIX H

PERCEIVED SKILL-UTILIZATION SCALE
## APPENDIX H

**PERCEIVED SKILL-UTILIZATION SCALE (O'BRIEN)**

### A. Do you have the chance to learn new jobs?

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<tbody>
<tr>
<td>Not At All</td>
<td></td>
<td>Very Little</td>
<td>Some</td>
<td>A Great Deal</td>
<td>A Very Great Deal</td>
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### B. Does your job allow you to work in the way you think best?

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<tr>
<td>Not At All</td>
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<td>Very Little</td>
<td>Some</td>
<td>A Great Deal</td>
<td>A Very Great Deal</td>
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### C. Does your job fully utilize your abilities?

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<tr>
<td>Not At All</td>
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<td>Very Little</td>
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<td>A Great Deal</td>
<td>A Very Great Deal</td>
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### D. Does your job fully utilize your training and experience?

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<tr>
<td>Not At All</td>
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<td>Very Little</td>
<td>Some</td>
<td>A Great Deal</td>
<td>A Very Great Deal</td>
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</tbody>
</table>
APPENDIX I

SUBJECTIVE WORKLOAD ASSESSMENT TECHNIQUE
APPENDIX G
SUBJECTIVE WORKLOAD ASSESSMENT TECHNIQUE

I. TIME LOAD

1. OFTEN HAVE SPARE TIME. INTERRUPTIONS OR OVERLAP AMONG ACTIVITIES OCCUR INFREQUENTLY OR NOT AT ALL.

2. OCCASIONALLY HAVE SPARE TIME. INTERRUPTIONS OR OVERLAP AMONG ACTIVITIES OCCUR FREQUENTLY.

3. ALMOST NEVER HAVE SPARE TIME. INTERRUPTIONS OR OVERLAP AMONG ACTIVITIES ARE VERY FREQUENT, OR OCCUR ALL THE TIME.

II. MENTAL EFFORT LOAD

1. VERY LITTLE CONSCIOUS MENTAL EFFORT OR CONCENTRATION REQUIRED. ACTIVITY IS ALMOST AUTOMATIC, REQUIRING LITTLE OR NO ATTENTION.

2. MODERATE CONSCIOUS MENTAL EFFORT OR CONCENTRATION REQUIRED. COMPLEXITY OF ACTIVITY IS MODERATELY HIGH DUE TO UNCERTAINTY, UNPREDICTABILITY, OR UNFAMILIARITY. CONSIDERABLE ATTENTION REQUIRED.

3. EXTENSIVE MENTAL EFFORT AND CONCENTRATION ARE NECESSARY. VERY COMPLEX ACTIVITY REQUIRING TOTAL ATTENTION.

III. PSYCHOLOGICAL STRESS LOAD

1. LITTLE CONFUSION, RISK, FRUSTRATION, OR ANXIETY EXISTS AND CAN EASILY BE ACCOMODATED.

2. MODERATE STRESS DUE TO CONFUSION, FRUSTRATION, OR ANXIETY NOTICEABLY ADDS TO WORKLOAD. SIGNIFICANT COMPENSATION IS REQUIRED TO MAINTAIN ADEQUATE PERFORMANCE.

3. HIGH TO VERY INTENSE STRESS DUE TO CONFUSION, FRUSTRATION, OR ANXIETY. HIGH TO EXTREME DETERMINATION AND SELF-CONTROL REQUIRED.
SUBJECTIVE WORKLOAD ASSESSMENT TECHNIQUE
VERBAL INSTRUCTIONS TO SUBJECTS

INTRODUCTION & ORIENTATION TO SCALE DEVELOPMENT PHASE

In this research, you are going to be asked to do office work on the computer. As part of the experiment, you will be asked to rate the mental workload that you experience. So that you can rate your workload in the experiment, we first need to know how each of you, as individuals, think of workload. Today, you will be shown a scale for rating workload, and you will be asked to rank the different combinations of workload ratings that you can make, from low to high. By doing this, you will begin to learn how to make workload ratings. The information that you provide will help us understand how you make workload ratings when you work on the computer in the actual experiment.

1. DESCRIBE CONCEPT OF WORKLOAD

Let’s start with the idea of physical workload. I’m sure we can easily think of the effort needed to lift, say, a heavy box, to shovel snow, or participate in our favourite sport. We can think about physical activities in terms whether relatively high or relatively low levels of physical workload is required to do them. Now what about mental work and mental workload? Our ideas about mental workload are affected by our experience with physical workload. But physical and mental work don’t always appear to be same thing. There may not always be a lot of physical effort when we are doing mental work. So what then is mental workload? When we speak of "mental workload," we are clearly referring in some sense to mental effort. We might think about mental workload as the amount of concentration required to write a paper, work simple addition problems or solve complex algebra problems. We would probably all agree that the amount of work required to solve a complex algebra problem would be greater than the amount of work required to solve an arithmetic problem, involving simple addition. Some mental tasks are clearly harder than others.

2. DESCRIBE PURPOSE OF EXPERIMENT

As part of the experiment in which you are going to participate, we will measure the amount of mental workload that you experience while you are performing office tasks on a computer.

3. SUBJECTIVE MEASURES OF WORKLOAD

In order to find out as much as possible about the mental workload that you experience, mental workload will be broken down into several dimensions, or factors, which are generally considered to comprise workload. As part of the experiment, you will be asked to rate the amount or degree of each factor that exists in the tasks that you are working on.
The rating method we are going to use is called the Subjective Workload Assessment Technique, or the SWAT for short.

4. **DESCRIBE SWAT**

The basic concept of the SWAT is that it describes your/subjective workload as being composed primarily of three dimensions, or factors [DIRECT SUBJECTS TO LOOK AT HANDOUT 1-- SWAT DIMENSIONS]. These dimensions, or factors, are: Time Load, Mental Effort Load, and Psychological Stress Load.

It is very important that you understand the meaning associated with the three dimensions and how they relate to the definition of workload. Let's now look at the SWAT workload dimensions in detail.

A. **Time Load**

Time load refers to the amount of time pressure that you experience in performing your task. This includes the fraction of total available time that you are busy and the degree to which different aspects of the task overlap or interfere with one another. Under high amounts of time load, you are unable to complete the task due to shortage of time or interference created by the overlap of activities.

For instance, imagine for a moment that you are writing an exam. There could be a high degree of time load caused by having a large number of problems to solve or questions to answer in a limited time. Notice that we are not considering anything about how much effort is involved in solving the problems or the stress level involved in this situation.

B. **Mental Effort Load**

Mental effort refers to the amount of attention and/or concentration required to perform a task. Tasks that require mental effort include memorizing and remembering things, making decisions, doing calculations, and solving problems. High levels of mental effort load are required in situations that demand total concentration, whereas lower levels of mental effort load are required when your mind wanders or your attention is divided over more than one 'easy' task component.

Mental effort can be involved in memorizing items, performing calculations on numbers, concentrating on listening to a speaker for important points, or making very difficult decisions. In the job that you will work on, the tasks could be very difficult to do, and require a lot of thinking, or they could be easy, because what has to be done is obvious.
C. Psychological Stress Load

Psychological stress load refers to the presence of confusion, frustration, and/or anxiety which hinders completion of your task. Psychological stress can come from pressure to do well, anxiety about physical dangers, tension, fatigue, your state of health. For instance, if you are taking an exam, and your grade is determined by your performance on a particular test, or if the room where you are writing the test is noisy, there would probably be a high level of stress. On the other hand, if your grade will not be affected much by how well you perform on the test, your stress level might be lower, regardless of the time pressure or the amount of concentration required.

3. DESCRIBE LEVELS WITHIN DIMENSIONS

In the experiment, you will be asked to rate how much of each of the three kinds of workload you experience.

For each of the three dimensions that contribute to workload, there are three levels which you can be use to give a rating. Level one is associated with the lowest degree of each of the three dimensions, level three is associated with the highest, and two is a middle degree. Each level of each dimension is described verbally. These descriptions are provided to define how you should evaluate the levels of each of the dimensions. The description of each level are as follows:

Time load

Level 1: Often have spare time. Interruptions or overlap among activities occurs infrequently or not at all.

Level 2: Occasionally have spare time. Interruptions or overlap among activities occur frequently.

Level 3: Almost never have spare time. Interruption or overlap among activities are very frequent or occur all the time.

Mental effort load

Level 1: Very little conscious mental effort or concentration required. Activity is almost automatic, requiring little or no attention.

Level 2: Moderate conscious effort or concentration required. Complexity of activity is moderately high due to uncertainty, unpredictability, or unfamiliarity. Considerable attention required.
Level 3: Extensive mental effort and concentration are necessary. Very complex activity requiring total attention.

Psychological stress load

Level 1: Little confusion, risk, frustration, or anxiety exists and can easily be accommodated.

Level 2: Moderate stress due to confusion, frustration, or anxiety noticeably adds to workload. Significant compensation is required to maintain adequate performance.

Level 3: High to very high stress due to confusion, frustration, or anxiety. High to extreme determination and self-control required.

4. EXAMPLES OF INTERACTIONS BETWEEN THE THREE DIMENSIONS

We will now look at some hypothetical situations to show how the SWAT ratings might be made.

[SHOW FIGURE] In the scene on the left, we have a pilot approaching an airfield on a clear, sunny day. Let's presume that she has made this landing many times before. In this situation for this pilot, the task of landing might get the rating of 1 for time load, 1 for mental effort load, and 1 for psychological stress load. Now, by contrast, in the scene on the right side, the situation is different: the pilot is trying to land in bad weather, with poor visibility. She might give a rating of 2 for time load since she is not able to see what is happening, so she is not able to perform the necessary actions as early as in the other situation, when the weather is clear. Previous situation. She may give a rating of 1 again for mental effort load, since the decisions and amount of concentration are very similar to the first situation. However, the psychological stress load may increase to a 3 since there could be increased anxiety about the landing due to the low visibility. Note that these ratings are intended to illustrate what a pilot might say and that for any given task any other combination of ratings is possible depending upon the precise task conditions. Since different people can give different ratings for a particular situation, we develop a workload scale that is unique for each person.

5. RANK ORDERING COMBINATIONS OF WORKLOAD

For now, we need information from you concerning the importance you place on the three dimensions, so that we can find, for each of you, the best way to combine the ratings you will give later. In order to develop your individual scale, we need information from you regarding the amount of workload you feel is imposed by the various combinations described above. You can tell us this information by rank
ordering the workload associated with each of the possible combinations. Look at the deck of cards in front of you. Each card shows a different combination of the three levels of Time Load, Mental Effort Load, and Psychological Stress Load. There is one card for each possible combination workload dimensions and levels. AS YOU CAN SEE, WITH THREE LEVELS OF EACH DIMENSION THERE IS A TOTAL OF THREE TIMES THREE TIMES THREE, OR 27 possibile combinations which could be given. IN THIS WAY, THERE ARE 27 CARDS. RANK ORDER THE CARDS FROM THAT COMBINATION WHICH REPRESENTS THE LOWEST WORKLOAD TO THE COMBINATION WHICH REPRESENTS THE HIGHEST WORKLOAD. DO THIS BY IMAGINING A SITUATION[/TASK] THAT YOU HAVE EXPERIENCED WHICH COULD BE DESCRIBED BY THE COMBINATION OF THE DIMENSIONS ON A PARTICULAR CARD AND MAKE A RELATIVE JUDGMENT ABOUT THE WORKLOAD ASSOCIATED WITH THAT TASK AND RANK ORDER THE CARDS ACCORDINGLY. IN OTHER WORDS, ARRANGE THE CARDS FROM THE LOWEST TO THE HIGHEST WORKLOAD FOR YOU.

When you are comparing cards, you may find that, for example, effort is higher in one situation while stress is higher in the other. When this happens, you must make a decision about which situation you would choose as lower in workload. To do this, you need to decide which dimension—effort or stress in this example—has a greater impact on overall workload to you. You will have to do this with different combinations of all three dimensions. There is no right or wrong answer to these decisions, since each person feels differently about the importance of the dimensions. The correct order is what, in your judgment best describes the progression of workload from lowest to highest for a general case rather than any specific event. That judgment differs for each of us. Some people feel that Time has the greatest impact, others feel it is effort, and still others feel that Stress is the most important, and so on.

As you try to imagine situations which could be described by the combinations on the cards, there may be combinations for which you have a hard time imagining a situation which fits. In this case, it might be helpful to assume that such a situation or event does exist and try to determine where it would rank in relation to the other situations.

6. **HOW TO RANK**

You may use any strategy you choose in rank ordering the cards. One strategy that might be useful is to arrange the cards into a number of preliminary stacks representing "High", "Moderate", and "Low" workload. Individual cards can be exchanged between stacks, if necessary, and then rank ordered within stacks. Stacks can then be recombined and checked to be sure that they represent your choice of lowest to highest workload. However, the choice of strategy is up to you and you should choose the one that works best for you.

Whatever way you choose to go about ranking the combinations of workload, please work carefully.
The letters you see on the back of the cards are to allow us to arrange the cards in a previously randomized sequence so that everyone gets the same order. [If you examine your deck you will see the order on the back runs from A through Z and then ZZ.]

7. **TIME**

You will probably need 30 minutes to an hour to complete the sorting. Please feel free to ask questions at any time. Thank you for your cooperation.
SUBJECTIVE WORKLOAD ASSESSMENT TECHNIQUE
WRITTEN INSTRUCTIONS TO SUBJECTS

THE CONCEPT OF WORKLOAD

Mental workload refers to how hard you work to accomplish some task, group of tasks, or an entire job. The workload imposed on you at any one time consists of a combination of various dimensions which contribute to the subjective feeling of workload. The Subjective Workload Assessment Technique (SWAT) defines three such dimensions of workload as: 1) Time Load, 2) Mental Effort Load and, 3) Psychological Stress Load.

TIME LOAD

Time load refers to the fraction of total available time that you are busy. When Time Load is low, sufficient time is available to complete all of your mental work with some time to spare. As Time Load increases, spare time is reduced and some aspects of performance overlap and interrupt one another. This overlap and interruption can come from performing more than one task or from different aspects of performing the same task. At higher levels of Time Load, several aspects of performance often occur simultaneously, you are busy, and interruptions are very frequent.

You may rate Time Load on the following scale:

Level 1: Often have spare time. Interruptions or overlap among activities occur infrequently or not at all.

Level 2: Occasionally have spare time. Interruptions or overlap among activities occur frequently.

Level 3: Almost never have spare time. Interruption or overlap among activities are very frequent or occur all the time.

MENTAL EFFORT LOAD

Mental Effort Load refers to the amount of attention or concentration required by a task. Mental Effort Load is low when the concentration and attention required by a task are minimal, and performance is nearly automatic. As the degree of concentration and attention required by a task increase, so does the demand for mental effort. When the task demands total attention and concentration, Mental Effort Load is high.
Mental Effort Load may be rated using the following scale:

Level 1: Very little conscious mental effort or concentration required. Activity is almost automatic, requiring little or no attention.

Level 2: Moderate conscious effort or concentration required. Complexity of activity is moderately high due to uncertainty, unpredictability, or unfamiliarity. Considerable attention required.

Level 3: Extensive mental effort and concentration are necessary. Very complex activity requiring total attention.

PSYCHOLOGICAL STRESS LOAD

Psychological Stress Load refers to the amount of anxiety, frustration, or confusion that you feel when performing a task. At low levels of Psychological Stress Load, one feels relatively relaxed. As Psychological Stress increases, confusion, anxiety, or frustration increase and make it harder for you to work on the task. Psychological Stress Load is high when the task requires extreme determination and self-control.

Psychological Stress Load may be rated on the following scale:

Level 1: Little confusion, risk, frustration, or anxiety exists and can easily be accommodated.

Level 2: Moderate stress due to confusion, frustration, or anxiety noticeably adds to workload. Significant compensation is required to maintain adequate performance.

Level 3: High to very high stress due to confusion, frustration, or anxiety. High to extreme determination and self-control required.

Each of the three dimensions described above contribute to workload when performing a task. Different tasks create different combinations of workload. Since different people can give different ratings for a particular situation, we develop a scale to be used for rating workload in the experiment that is unique for each person.

INSTRUCTIONS FOR RANK ORDERING COMBINATIONS OF WORKLOAD

So that we can develop your individual scale, we need information from you regarding the amount of workload you feel is imposed by each of the various combinations described above. You can tell us this information by rank ordering the workload associated with each of the possible
combinations.

1. Look at the deck of cards in front of you. Each card shows a different combination of the three levels of Time Load, Mental Effort Load, and Psychological Stress Load.

2. RANK ORDER THE CARDS FROM THAT COMBINATION WHICH REPRESENTS THE LOWEST WORKLOAD TO THE COMBINATION WHICH REPRESENTS THE HIGHEST WORKLOAD FOR YOU. TO DO THIS, IMAGINE A SITUATION THAT YOU HAVE EXPERIENCED WHICH COULD BE DESCRIBED BY THE COMBINATION OF THE DIMENSIONS ON A PARTICULAR CARD AND MAKE A RELATIVE JUDGMENT ABOUT THE WORKLOAD ASSOCIATED WITH THAT TASK AND RANK ORDER THE CARDS ACCORDINGLY.

3. When you are comparing cards, you may find that, for example, effort is higher in one situation while stress is higher in the other. When this happens, you must decide which situation you would choose as being lower in workload. To do this, you need to decide which dimension—effort or stress in this example—has a greater impact on overall workload to you. You will have to do this with different combinations of all three dimensions. There is no right or wrong answer to these decisions. The correct order is what sequence, in your judgment, best describes the progression of workload from lowest to highest.

4. As you try to imagine situations which could be described by the combinations on the cards, there may be combinations for which you have a hard time imagining a situation which fits. In this case, it might be helpful to assume that such a situation or event does exist and try to determine where it would rank in relation to the other situations.

5. **HOW TO RANK**

You may use any strategy you choose in rank ordering the cards. One strategy that might be useful is to arrange the cards into a number of preliminary stacks representing "High", "Moderate", and "Low" workload. Individual cards can be exchanged between stacks, if necessary, and then rank ordered within stacks. Stacks can then be recombined and checked to be sure that they represent your choice of lowest to highest workload. However, the choice of strategy is up to you and you should choose the one that works best for you.
APPENDIX J
PERCEIVED PRODUCTIVITY SCALE
APPENDIX J

PERCEIVED PRODUCTIVITY SCALE
(Gardner, 1986)

How productive was your work?
1--------2--------3--------4--------5--------6--------7
very productive somewhat productive very productive

How effective was your work?
1--------2--------3--------4--------5--------6--------7
very effective somewhat effective very ineffective

How useful was your work?
1--------2--------3--------4--------5--------6--------7
very useful somewhat useful useless

How valuable was your work?
1--------2--------3--------4--------5--------6--------7
very valuable somewhat valuable worthless
APPENDIX K

TASK ATTRACTIVENESS AND TASK COMPLEXITY SCALES
## SEMANTIC DIFFERENTIAL SCALES OF MORALE

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<thead>
<tr>
<th>General Arousal</th>
<th>Extremely</th>
<th>Quite</th>
<th>Slightly</th>
<th>One Other</th>
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<th>Quite</th>
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<td>1. INTERESTED</td>
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<td>3. SPIRITED</td>
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<td>9. SUPERIOR</td>
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<td>10. WHOLESOME</td>
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<td>11. DIFFICULT</td>
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<td>12. COMPLEX</td>
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<td>13. ROUTINE</td>
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APPENDIX L

INSTRUCTIONS
APPENDIX L

INSTRUCTIONS TO SUBJECTS

Today, you are going to be asked to do office work on the computer. First, you will learn how to use the computer. You will work through a tutorial on the computer, which will show you what to do, step by step. At each step, you will practice what you learn. Also, I will be available to answer your questions during this part.

Then you will be asked to work at a job that is made up of 3 tasks that you might have to do in an office. In this job:

COMPLEX CONDITION

You might have to do accounting-related work. You might be asked to take a lot of different financial transactions, such as bills and cheques, and classify them and record them.

You might have to do correspondence. You might be asked to write letters and memos, given the necessary information about what to say and who to send it to. You would then compose and write the letter or memo.

You might have to verify work when it is finished. You might be asked to check a document that has already been written and typed before it is sent out. You would then proofread the document and correct any mistakes before it is sent out.

SIMPLE CONDITION:

You might have to do accounting-related work. You might be asked to take financial transactions and record them into the accounts to which they belong on the computer.

You might have to handle correspondence. You might be asked to type letters and memos on the computer.

You might have to verify work when it is finished. You might be asked to check a document that has already been written and typed, before it is sent out. You would then look at a printed copy of the document and enter the corrections indicated on the computer.

HIGH JOB DECISION LATITUDE CONDITION:

Like many jobs, the three tasks which make up this job need not always be performed in the same sequence. In this job, you can switch tasks whenever you want. Feel free to switch tasks at different times, making sure that you have tired all the tasks as the computer will stop you when 15 minutes have elapsed. Your total working time is 45 minutes.
LOW JOB DECISION LATITUDE CONDITION:

Like many jobs, the tasks which make up this job should always be performed in some definite sequence. In this job, you will be instructed as to which tasks to perform, and when. These instructions will be given to you as messages on the computer screen. Follow the instructions about which task to work on, and when, carefully.

FOR ALL SUBJECTS:

In front of you, there are three files, one for each of the three tasks in your job. The files are marked: Correspondence, Proofreading, and Accounting. In each file, you will find your work assignment for the task, along with further instructions about what to do.

There is a lot of work to be done, so don’t expect to finish all the work for any of the three tasks. Try to work as accurately and as quickly as you comfortably can.

All the work you do will be saved automatically.

After the work session, you will be asked to fill out a questionnaire about your reactions to the job that you have done.

WORKLOAD RATINGS:

At the first meeting, you were shown a scale for rating how much mental workload you feel while you are working. This scale, which is called the Subjective Workload Assessment Technique, asks you to rate your workload in terms of how much Time Load, Mental Effort Load, and Psychological Stress Load you feel while you are working at a given task. Today, you will be asked to rate each of the tasks that you are working on twice, at half time and at the end of the time that you are working on each task. The three scales will appear on the computer screen, one after another, and you type your ratings of the task that were working on into the computer. Remember, rate your workload perceptions only on one task at a time. In other words, rate only the task that you were working on immediately before you are asked to rate. You will rate your workload for each of the three tasks.

Right now, please take a few minutes to look at the workload rating information on your desk, and review carefully the definitions of the three workload scales for Time Load, Mental Effort Load, and Psychological Stress Load, along the three levels of ratings that you can make for each. Do you have any questions?

INTRODUCTION TO CALDWELL INDUSTRIES

You are working for Caldwell Industries, a local manufacturing company.
APPENDIX M

COMPUTER TUTORIAL
The quality of this microfiche is heavily dependent upon the quality of the thesis submitted for microfilming.

Please refer to the National Library of Canada target (sheet 1, frame 2) entitled:
INTRODUCTION TO WORKING ON THE COMPUTER: HOW TO USE THE KEYBOARD

The following is a step by step tutorial designed to introduce you to working on the computer. If you are already familiar with using computer keyboards, then consider the tutorial as a refresher to familiarize yourself with the system that you are going to be working on.

To begin the tutorial, press the key marked <ESC>.

You use the keyboard to communicate with the computer. By typing letters, symbols, and numbers, you may enter information into the computer's memory. Also, you can control the computer's operations by pressing certain keys on the keyboard.

Mostly, you are going to be using the same keys as you would use on a typewriter. The main keys are those for the alphabet (A-Z), digits (0-9), and symbols (such as !, $, &, etc.). The space bar, at the bottom centre of the keyboard, is for typing blank spaces. The Shift keys on either side of the keyboard allow you to type uppercase letters or to type symbols instead of numbers. The Enter key lets the computer know that you are finished typing for now, and ready to go on.

Since you may not be familiar with some of the keys, you will have the opportunity to practice using all the keys that you need for doing your work on the computer.

Notice the small dark rectangle on the left in the box below. This rectangle is called the cursor. It indicates where you are working on the screen. Now, type the letter a. Notice that the letter appears where the cursor was before, and the cursor has moved over one space to the right. Now, type the letter k, followed by a space, then the words fine job.

PRESS <ESC> TO CONTINUE
Now, type the following letters indicated in the box below. Use the space bar once to move from one group of letters to the next.

WORK AS FAST AND AS CAREFULLY AS YOU CAN

xxxxxxx

fff ddd jjj ddd kkk sss lll aaa ;;; eee uuu ggg

xxxxxxx

rrr ... hhh lll ooo ttt ... mmm ccc www yyy vvv

xxxxxxx

nnn xxx PPP BBB /// ZZZ QQQ lll 777 222 888 333

xxxxxxx

PRESS <ESC> TO CONTINUE
Now, type the following letters indicated in the box below. Use the space bar once to move from one group of letters to the next. Use the (SHIFT) key to type capital letters.

XXX
X
X 999 444 000 555 AAA JJJ QQQ PPP XXX MMM TTT YYY
X
X
X
X
XXX

PRESS <ESC> TO CONTINUE

Now, type the following letters indicated in the box below. Use the space bar once to move from one group of letters to the next. Use the (SHIFT) key to type capital letters.

XXX
X
X !!! "" "" --- +++ === ?? @@@ ((( ))) sss
X
X
X
X
XXX

PRESS <ESC> TO CONTINUE
To type words in capital letters, press the (CAPS LOCK) key once. When you want to return to lowercase typing, press the (CAPS LOCK) key once again. Now, type the words indicated in the box below.

```
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x
x  The quick BROWN FOX runs through the UNIVERSITY  x
x
x
x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

PRESS <ESC> TO CONTINUE

```
.WINDOW 14.10-14.56
.CURSOR 14.10
.VERIFY "The quick BROWN FOX runs through the UNIVERSITY"
.PAGE
```

What if you make a mistake? The word "gulf" appears in the box below. Let's assume that you wanted type the word "golf" instead. There are two ways you can correct what you have typed. One way to change what you have typed is to use the (BACKSPACE) key to erase it. In the box below, press the (BACKSPACE) key three times. Then, type in the letters "o", "l", and "f".

```
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
x
x  gulf
x
x
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

PRESS <ESC> TO CONTINUE

```
.WINDOW 14.10-14.56
.INITVALU "gulf"
.CURSOR 14.14
.VERIFY "golf"
.PAGE
```
Another way in which to change what you have typed is to use the ARROW keys, located on the right side of the keyboard, and the DELETE key. In the box below, let's assume that you are going to change the word "golf" back to "gulf". Use the LEFT ARROW key to move the cursor to the left, so that it is on top of the letter "o" in golf. Now, press the DELETE key once. Notice that the "o" is erased. You can now type the letter "u" in its place.

```
 xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
  x
  x  golf
  x
  xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

PRESS <ESC> TO CONTINUE

You can use all four ARROW keys to move the cursor around the screen. Use them, along with the (BACKSPACE) and (DELETE) keys to correct the mistakes in the second paragraph below.

```
 xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
  x This paragraph contains a very large number of x
  x spelling mistakes! Using the CURSOR keys and x
  x BACKSPACE and DELETE keys try to correct these x
  x blunders. When you have finished, press ESC. x
  xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

 xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
  x These paragraph contane a vry large number off x
  x spelling mistooks! Uesing th CURSR kees and x
  x BCKSPAC and DEDELETE kees tto correkt thees x
  x bludners. Wen yoo hav finnishd, prsse ECS. x
  xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

PRESS <ESC> TO CONTINUE

.CURSOR 16.09
.WINDOW 16.09-19.58
.INITVALU "These paragraph contane a vry large number off"
.INITVALU "spelling mistooks! Uesing th CURSR kees and"
.INITVALU "BACKSPACE and DELETE kees tto correkt thees"
.INITVALU "bludners. Wen yoo hav finnishd, prsse ECS."
.VERIFY "This paragraph contains a very large number of"
.VERIFY "spelling mistakes! Using the CURSOR keys and"
.VERIFY "BACKSPACE and DELETE keys try to correct these"
.VERIFY "blunders. When you have finished, press ESC."
.PAGE
Now, practice typing the sentences in the box below. When you have finished typing a line, use the ENTER key to move the cursor to the beginning of the next line.

```
x x x Your paper will arrive within the hour.
x x x The jury thinks a fight is never right.
x x x Dear Jody: The trip to Quebec was quite
x x x exciting. May I tell you all about it?
x x x
```

PRESS <ESC> TO CONTINUE

The text that you are now going to enter into the computer is on your desk, in the file marked "TUTORIAL". You will now be using the whole screen. Look at the section of text at the top of page 1.

Press the <ESC> key to start, and press it again when you have finished typing the letter.

PRESS <ESC> TO CONTINUE

WHEN YOU HAVE FINISHED TYPING, PRESS <ESC> TO CONTINUE
KEYBOARD SKILL ASSESSMENT

The text that you are now going to enter into the computer is also on the same page in the file marked "TUTORIAL". Find the section of text under "KEYBOARD SKILL ASSESSMENT", and look at it. You will again be using the whole screen. When you are ready, press the <ESC> key to start, and BEGIN WORKING IMMEDIATELY. Press the <ESC> key again AS SOON AS YOU HAVE FINISHED typing the rest.

WORK AS FAST AND AS CAREFULLY AS YOU CAN.

PRESS <ESC> AND BEGIN TYPING IMMEDIATELY

WHEN YOU HAVE FINISHED TYPING, PRESS <ESC> TO CONTINUE

You will now learn how to enter accounting information into the computer. Please follow the instructions carefully.

PRESS <ESC> TO CONTINUE

A financial transaction is an exchange which has 2 parts: (1) a value is received in exchange for (2) a value that is given. For the purpose of accounting, a financial transaction is recorded in 2 accounts, to show what is given and what is received.

Press (ESC) to continue

Caldwell Industries use 5 types of financial transactions:

1. Sales-Cash
2. Sales-Credit
3. Purchases-Cash
4. Purchases-Credit
5. Accounts Received

Press (ESC) to continue
Each of these 5 types of transactions has to be recorded into 1 account on the computer. These 2 accounts, called the "A" and "B" account respectively, are different for each kind of transaction. The 5 types of transactions, and their corresponding "A" and "B" accounts, into which the accounting information should be recorded, are shown in the A/B rule table. This table can be found on your desk, and is also displayed for your convenience on the next screen.

Press (ESC) to continue.

A/B RULE TABLE

<table>
<thead>
<tr>
<th>TYPE OF TRANSACTION</th>
<th>TRANSACTION IS RECORDED IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sales-Cash</td>
<td>ACCOUNT A AND ACCOUNT B</td>
</tr>
<tr>
<td></td>
<td>Cash-Received AND Sales</td>
</tr>
<tr>
<td>2. Sales-Credit</td>
<td>Accounts Receivable- Sales</td>
</tr>
<tr>
<td></td>
<td>Receivable</td>
</tr>
<tr>
<td>3. Purchases-Cash</td>
<td>Purchases AND Cash Paid Out</td>
</tr>
<tr>
<td>4. Purchases-Credit</td>
<td>Purchases AND Accounts Payable- Payable</td>
</tr>
<tr>
<td>5. Received on Accounts</td>
<td>Cash-Received AND Accounts Receivable -Collected</td>
</tr>
</tbody>
</table>

Take a brief look at this table, then press (ESC) to continue.

Now find the 2 practice transactions on your desk. Notice that there are 2 types of transactions. The first transaction is an invoice for a CASH SALE BY Caldwell Ind. TO Ellerbee, Inc. The second transaction is also an invoice, but it is a credit purchase BY Caldwell Ind. FROM Taylor Machinery.

Next, take a look at the screen on which you will be entering the accounting information into the computer.

Press (ESC) to continue.
ENTER DATA HERE

Name:

Date: MM/DD/YY

Transaction Number:

Account Number:

Amount: $ __________

For an explanation, press (ESC).

---

ENTER DATA HERE

Name:

Date: MM/DD/YY

Transaction Number:

Account Number:

Amount: $ __________

Press (ESC) to continue.

---

Chart of Accounts

Cash-Receipts
Sales
Accounts Payable
Purchases
Cash Paid
Accounts Receivable
Collections

The accounting screen is split into two sides. On the left side, shown here, is the area for entering the accounting information from the transaction records into the computer. The name, date, transaction number and amount are to be transferred here from the transaction record. The number of the account in which the transaction is to be recorded can be found on the right side of the screen and in the rule table.
The right side of the accounting screens shows the names of the accounts that Caldwell Industries use, and their corresponding numbers on the computer. To record a transaction in a given account, look up the name of the account and its number. Then, type this number on the "Account Number" line on the left side of the screen. For example, if a transaction belongs in the sales account, type in "2" on the "Account Number" line.

Press <ESC> to continue

In order to enter the transaction into the computer:

1. Type in the name of the company, then press the <ENTER> key.

2. Type in the date, including slashes (/), then press the <ENTER> key.

3. Type in the transaction number, then press the <ENTER> key.

4. Type in the number of the first account in which the transaction is to be recorded, then press the <ENTER> key.

5. Type in the amount, ignoring commas, then press the <ENTER> key.

6. The computer will then ask for the second account number. Type this number in over the first one, and press the <ENTER> key. The transaction is now recorded in both accounts.

7. Press the <ESC> key to proceed to the next transaction.

Press <ESC> to continue
Now please do the following two steps:

1. Look at the first transaction again. This is a cash sale:
   To the Ellerbee Co. (Name), on May 5, 1968, invoice No. 2255, for the amount of $4627.02.

2. Look at the A/B RULE TABLE on your desk to see in which accounts a cash sale should be recorded on the computer. According to the A/B RULE TABLE, information from a SALES-CASH transaction should be entered in BOTH the "CASH-RECEIVED" account and the "SALES" account. In the RIGHT side of the accounting screen, the "CASH-RECEIVED" account is listed as number "1", and the "SALES" account is listed as number "2". You enter these numbers on the LEFT side of the accounting screen.

To continue, press (ESC) and enter the required information.

Now, move on to the next transaction and do the following steps:

1. This transaction is a purchase on credit BY Caldwell Ind. FROM Taylor Machinery (Name), invoice No. 814 (Transaction No.), on May 17, 1968 (Date), for the amount of $8739.45.

2. Look at the A/B RULE TABLE. A purchase on credit should be recorded in BOTH the "PURCHASES" account AND the "ACCOUNTS PAYABLE" accounts on the computer. On the RIGHT side of the accounting screen, the "PURCHASES" account is listed as number "4", and the "ACCOUNTS PAYABLE" account is listed as number "6". You enter these numbers on the LEFT side of the accounting screen.

Press (ESC) and enter the transaction into the computer.

You are almost ready to begin working on your job. Like many jobs, the three tasks which make up your job always be performed in some definite sequence. In this job you will be instructed as to which task to work on and when. The computer will tell you when to start and when to stop working on each task, and when your job is finished.

Press (ESC) to continue
On your desk, you will find files containing specific instructions and materials for each task. Do not look inside these files yet. When you begin work on a task for the first time, press the (F1) key and read the instructions. As soon as you have finished reading the instructions, press the (F1) key again and begin working.

If you need to read the instructions for a task again, ALWAYS PRESS THE (F1) KEY WHEN YOU BEGIN, AND AGAIN WHEN YOU FINISH. Do not press the (F1) key for any other reason.

Press (ESC) to continue.

You have completed the tutorial.

Press (ESC) to rate your workload and begin your job.
APPENDIX N

ANALYSES OF VARIANCE WITH ABILITY MEASURES AS DEPENDENT VARIABLES
APPENDIX N

Analysis of Variance on Composite MAB Verbal Ability Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BETWEEN BLOCKS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TC</td>
<td>1</td>
<td>458.387</td>
<td>458.387</td>
<td>4.67</td>
<td>.09</td>
</tr>
<tr>
<td>TA(TC)</td>
<td>67</td>
<td>10608.710</td>
<td>158.338</td>
<td></td>
<td></td>
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<tr>
<td><strong>WITHIN BLOCKS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JDL</td>
<td>1</td>
<td>32.594</td>
<td>32.594</td>
<td>0.30</td>
<td>.58</td>
</tr>
<tr>
<td>TC X JDL</td>
<td>1</td>
<td>28.498</td>
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<td>0.26</td>
<td>.61</td>
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<td>RESIDUAL</td>
<td>65</td>
<td>7076.240</td>
<td>108.865</td>
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<td></td>
</tr>
</tbody>
</table>

Note. TC: Task Complexity
       TA(TC): Time Allocation, blocked under Task Complexity
       JDL: Job Decision Latitude
APPENDIX N (Continued)

Analysis of Variance on Composite MAB Performance Ability Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
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<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BETWEEN BLOCKS</strong></td>
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<td></td>
</tr>
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<td>.55</td>
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<tr>
<td>JDL</td>
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<td>1960.319</td>
<td>17.50</td>
<td>.00*</td>
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<tr>
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<tr>
<td>RESIDUAL</td>
<td>65</td>
<td>7309.740</td>
<td>112.457</td>
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</table>

*Note. TC: Task Complexity
TA(TC): Time Allocation, blocked under Task Complexity
JDL: Job Decision Latitude

* p < .001
APPENDIX O

ANALYSIS OF VARIANCE WITH LOCUS OF CONTROL
SCORE AS DEPENDENT VARIABLE
APPENDIX O

Analysis of Variance on Internal Control Index Scores

<table>
<thead>
<tr>
<th>Source of Variance</th>
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<th>Sum of Squares</th>
<th>Mean Square</th>
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<th>P</th>
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<tr>
<td>JDL</td>
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<td>546.394</td>
<td>4.25</td>
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</tr>
<tr>
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<td>2.49</td>
<td>.11</td>
</tr>
<tr>
<td>RESIDUAL</td>
<td>63</td>
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<td>136.652</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. TC : Task Complexity  
TA(TC) : Time Allocation, blocked under Task Complexity  
JDL : Job Decision Latitude

* p < .05.
REFERENCES


O'Reilly, Parlette, & Bloom (1980).


VITAE AUCTORIS

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EDUCATION

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