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AUTOMATE OR INFORMATE? AN INVESTIGATION OF THE EFFECTS OF INFORMATION TECHNOLOGY ON MOTIVATION AND PERFORMANCE

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ABSTRACT

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The results of this research expands upon publication #94-15 which supported the notion that there are at least two distinct types of information technology that affected individual task motivation. Here, we also show support for these two types of information technology that affect task performance. Additionally, this research supports the hypotheses that task discretion moderates the relationship between both information technology and task motivation and the relationship between information technology and task performance.

Note: This paper adds the performance dimension to publications 94-15.

AUTOMATE OR INFORMATE? AN INVESTIGATION OF THE EFFECTS OF INFORMATION TECHNOLOGY ON MOTIVATION AND PERFORMANCE

Information technology (IT) has been hailed as one the most important technological developments in recent times (Franz, Robey, & Koeblitz, 1986). Indeed, many researchers have stated that information technology may well be one of the most important and interesting areas of inquiry of the decade (e.g., Gerstein, 1987; Porter, 1985). Additionally, information technology spending has doubled as a percent of revenues throughout the last decade (Benjamin & Blunt, 1992). In spite of this fact, little is known about the effects of this new technology in the workplace, and in particular, on jobs.

Two basic, opposing views exist with regard to the impact of information technology. First, some argue that the computerized workplace is inhumane and workers' jobs are robbed of enriching elements (Attewell & Rule, 1984). These deskilled jobs produce dissatisfaction, alienation, and reduced motivation to perform. Or, contrarily, others view the computer as a liberator (Mesthene, 1970). The machine helps to remove monotony and make jobs more enriched and satisfying.

Research efforts have been too inconsistent and sparse to support either scenario strongly (Attewell & Rule, 1984). In 1966, Hill reported that few empirical studies have identified or described the effects of computerized information system use. Twenty-two years later, Parsons (1988) reported that empirical research on job changes due to computerization is surprisingly sparse. Therefore, the question remains: what is the impact of information technology on workers and the jobs they perform? The purpose of this study is to attempt to answer this question by examining the effects of information technology on motivation and performance.

Types of Information Technology

Information technology refers to computer-mediated work where a task is accomplished through the medium of the information system rather than through direct physical contact with the task (Zuboff, 1985). According to Zuboff (1988) two types of information technology exist: automated and informated. First, an automating technology can be designed and implemented to lessen or deskill the processes which make up the work. By substituting technology for human labor, greater control and continuity over the work process can be achieved (Zuboff, 1988). Second, information technology can be designed and implemented to upgrade or enrich the processes which define the work. The objective of an informated technology is to remove the most boring, repetitious, dangerous and mindless tasks from the work, leaving human labor to perform the creative, challenging, intellectual, and satisfying aspects of the work (Orlikowski, 1988).

While this typology of information technology is useful, little empirical research exists as to its validity and as to the effects of each type on employee reactions. We propose that the work design and task complexity literatures provide a foundation for examining these effects.

Work Design and Motivation

Work design is the study of jobs, tasks, and constellations of tasks that encompass properties, perceptions, and responses to properties and/or perceptions (Griffin & McMahan, 1995). Because information technology affects workers primarily through impacting the way that work is performed, the work design literature has great potential for examining the effects of IT on worker motivation.

Hackman and Oldham (1976; 1980) provided the foundation for most of the studies of work design with their theory that relates the restructuring of work content to psychological processes. The authors hypothesized that three critical psychological states determine an individual's motivation and satisfaction on the job, which in turn affect performance, absenteeism, and turnover. These three states are a) experienced meaningfulness, b) experienced responsibility, and c) knowledge of results. Hackman and Oldham (1976; 1980) argued that these states are present when the work content is high on the five core job dimensions of Skill Variety (i.e., the opportunity to use a number of different skills on the job), Task Identity (i.e., the opportunity to complete a meaningful, whole piece of work), Task Significance (i.e., the opportunity to perform a job that affects the well being of other people), Autonomy (i.e., the opportunity to make decisions relating to the work process), and Feedback (i.e., the opportunity to learn how well one is performing the job).

Campion and his associates (e.g., Campion & Thayer, 1985; Campion, 1988) introduced an interdisciplinary approach to job design. Campion has argued that there are actually several distinct dimensions to studying jobs. Each of these dimensions is supported by a separate discipline with its own literature. The four distinct dimensions, which together comprise what he defines as the interdisciplinary perspective, are the motivational dimension, the mechanistic dimension, the perceptual-motor dimension, and the biological dimension.

As described and defined by Campion and Thayer (1985), the motivational dimension to job design is that view most similar to the conceptualizations of job design developed from the organizational psychology perspective discussed above. Grounded in the earlier work on job enrichment, job enlargement, and various characteristics of jobs, the motivational dimension has primarily been developed within the domain and scope of organizational behavior and organizational psychology. Research on motivation has generally searched for job design constructs that will be correlated with such primary outcome variables as satisfaction, motivation, involvement, absenteeism, and job performance.

The mechanistic dimension to job design draws primarily from the literature on industrial engineering. The early foundation of this dimension was developed by Taylor (1911) and Gilbreth (1911) and includes basic ideas and arguments from scientific management, time and motion study, and work simplification practices (Campion, 1988). The emphasis of this perspective has generally been on improving the efficiency with which jobs can be performed.

The perceptual-motor dimension is derived from research on human factors engineering. This dimension has its roots in experimental psychology and which tends to focus on job skills levels and information processing requirements. Job design from the perceptual-motor dimension emphasizes the limitations and capabilities of job incumbents in their person-machine interactions.

The biological dimension stems from research on work physiology, ergonomics, biomechanics (body movements), and anthropometry (body sizes) (Campion, 1989). Job design that emphasizes the biological dimension focuses on designing jobs that have low levels of physical stress and physical discomfort.

It is the motivational and mechanistic trade-off that forms the basis of the study of job design (Griffin & McMahan, 1995). Regardless of how it is presented, the basic thrust of most job design theory and research has rested on the premise that job design and motivation are linked (Griffin, 1982; Griffin & McMahan, 1995; Hackman & Lawler, 1971; Lawler, 1969; Turner & Lawrence, 1965). The implicit belief that has guided work in this area has been that the design of jobs can be altered so as to motivate job incumbents to work harder, to do higher quality work, to do more work, and to be more satisfied as a result of having worked. The implications of the motivational approach directly contradict the job design principles suggested by the mechanistic approach.

The mechanistic approach rests on the premise that jobs should be designed in a way that incumbents perform fewer, simpler, and more repetitive tasks in order to maximize human resource efficiency and minimize training requirements (Campion, 1988). Implicit in this approach is an emphasis on designing the most efficient means of performing work without regard to the motivational potential/satisfaction of job incumbents. This observed trade-off between the motivational and mechanistic approaches to jobs mirrors that of the two views of information technology, as automated technologies seem to be consistent with mechanistic principles of job design while informated technologies evidence consistency with motivational principles of job design. Thus, the job design literature provides a foundation for examining the effects of information technology on motivation.

Task Complexity and Performance

In large part, the mechanistic and motivational approaches to job design differ with regard to their suggestions for the optimal level of task complexity. The construct of task complexity is an important determinant of individual performance through the demands it places on the knowledge, skills, and resources of task performers (Wood, 1986). There have been a handful of complexity definitions that focus on different types of tasks. These definitions of task complexity include those relating to judgment tasks (Naylor & Dickinson, 1969), group tasks (Oeser & O'Brien, 1967), intergroup tasks (Thompson, 1967), and individual tasks (Wood, 1986). The most useful in this case is the Wood (1986) definition which has a focus on individual task performance.

Wood (1986) defined total task complexity as a function of three types of task complexity: a) component, b) coordinative, and c) dynamic. The author defines component complexity as the activities and events that an individual needs to be cognizant of and able to perform. This means that as the number of non-redundant activities increase, so does the information necessary to perform the task. Coordinative complexity refers to the sequencing and timing requirements for performance of required activities (Wood, 1986). The higher the degree of the sequencing and timing requirements, the greater the knowledge and skill an individual must have to perform the task. Finally, dynamic complexity refers to changes in the task environment which have an effect on the relationships between task inputs and outputs. Wood (1986) stated that changes in either the set of required activities or information cues or the relationships between inputs and outputs can create shifts in the knowledge or skills required for a task.

Task complexity forms the foundation for exploring the differences in the two approaches to the use of technology in job design. The motivational approach, in an effort to increase the motivational nature of the task, seeks to increase component complexity. The mechanistic approach seeks to maximize individual efficiency by decreasing the component complexity of jobs. These different views of optimal complexity of the task stem from different goals (motivation versus efficiency) and result in different applications of information technology (automate versus informate).

HYPOTHESES

Figure 1 presents as an attempt to define the causal relationships between the types of information technology and job design dimensions that may influence a job incumbent's perceptions and work outcomes. This model depicts the hypotheses to be tested in this paper.

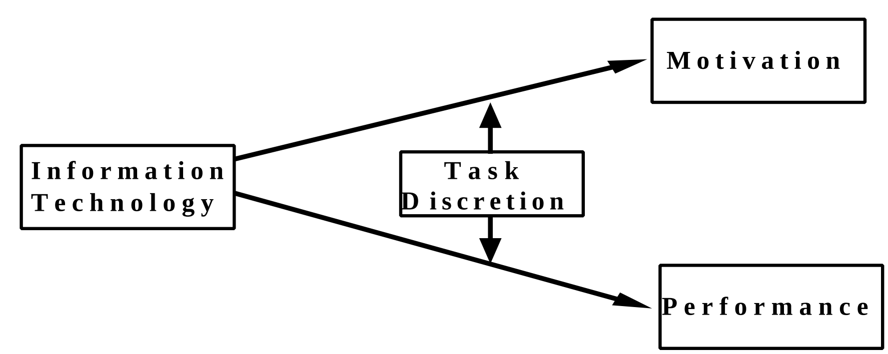

Figure 1: ***Causal Model of the Hypothesized Relationships Among Information Technology; Task Discretion; Motivation and Performance***

We contend that Zuboff's automate/informate distinction, in large part describes a low versus high discretion distinction. However, a challenge inherent in research on information technology is to separate the technology from the job design characteristics. The design of the study allowed us to manipulate technology (computer versus manual) and job characteristics (low versus high discretion). The hypotheses are built upon the separation of these independent effects.

Years of job design research have shown that greater motivational potential is associated with tasks which are more enriched or have greater discretion (e.g., Rousseau, 1977; Wall & Martin, 1987). By discretion, we mean that individuals are permitted some level of autonomy in the procedures and decisions regarding the job. Both the job characteristics model (Hackman and Oldham, 1971) and the interdisciplinary approach (Campion and Thayer, 1985) propose that jobs that are high in individual discretion are, for the most part, more motivating in nature. It is safe therefore to assume that a task which involves higher levels of discretion should produce a higher self-reported level of motivation from an individual performing a task (Hackman & Oldham, 1976; 1980) regardless of the type of information technology.

It can be argued that task complexity is an outcome of increased discretion. Providing discretion to jobs increases the component complexity by requiring individuals to process more information, make decisions, and engage in more non-redundant tasks. While this increase in complexity increases the motivational nature of the job, it decreases the efficiency of the job. Therefore, an increase in task complexity due to an increase in discretion will negatively impact performance.

Hence, hypothesis one:

HYPOTHESIS 1A: In a task which involves discretion, subjects will express a significantly higher level of self-reported motivation than they would in a task with little or no discretion.

HYPOTHESIS 1B: In a task which involves discretion, subjects' performance will be significantly lower than it will be in a task with little or no discretion.

As discussed earlier, there are mixed results on the impact of information technology on motivation. Pierce (1984), using a sociotechnical systems perspective, noted that employees perceived and described their jobs as routine when they interacted with a system-controlled technology. Additionally, Zuboff's (1988) theoretical argument of an automated technology is congruent with the above finding. Therefore, if an information technology system is applied to work processes alone, with no discretion or enrichment enhancement efforts, the information technology would solely increase control and continuity over those associated work processes. In this case, motivational properties would decrease due to the increase in system control.

The advent of information technology has been viewed by many as a way to increase the performance capability of work (e.g., Zuboff, 1988). Information technology can remove, for the most part, the human element which is viewed as highly variable, from being as significant a factor in the performance equation. Additionally, information technology can be focused on removing the tedious and monotonous aspects of work thereby allowing these more redundant tasks to be performed more efficiently. Therefore, information technology should significantly increase performance of a task.

Hence, hypothesis two:

HYPOTHESIS 2A: In a task which involves the use of information technology, subjects will express a significantly lower level of self-reported motivation than they will in a task which does not involve the use of information technology.

HYPOTHESIS 2B: In a task which involves the use of information technology, subjects' performance will be significantly higher than in a task which does not involve the use of information technology.

Based on the hypotheses above, it is obvious that the level of discretion inherent in a task is a critical issue in answering the question of the impact of information technology on the motivational dimensions of a job (Rousseau, 1977). We contend that the relationship between information technology and perceived motivational level of the task is moderated by the level of task discretion inherent in the task.

With regard to performance, as previously hypothesized, an increase in discretion creates higher task complexity which negatively affects performance due to inadequate strategy development (Campbell, 1984). Complexity itself, as caused by the introduction of task discretion would arguably slow down performance on an individual task. However, the information technology allows individuals to more quickly perform some of the complex tasks of the job. Thus, the decrements in performance attributable to discretion should not be as evident when information technology is present. We argue that task discretion would moderate the relationship between information technology and performance.

Hence, hypothesis three:

HYPOTHESIS 3A: The relationship between information technology and the self-reported motivational dimension of a task is moderated by the level of task discretion such that the negative impact of information technolgy on self -reported motivational dimensions will be stronger when discretion is low relative to when discretion is high.

HYPOTHESIS 3B: The relationship between information technology and the performance of a task is moderated by the level of task discretion such that the positive impact of information technology on performance will be stronger when discretion is low relative to when discretion is high.

By definition, an informated technology is a more enriched way of using information technology capacities (Zuboff, 1985; 1988). Therefore, an automated technology, which is focused solely on control and continuity properties, would differ from an informated technology on the motivation dimension. Alternatively, an informated technology focuses not only on the control and continuity features inherent in a system controlled technology (Pierce, 1984), but also possesses the comprehensibility dimension which allows for the use and understanding of task information (Zuboff, 1985). This increase in information processing activities would result in a lower level of performance (Wood, 1986). It is important to note that this is the first direct empirical test of Zuboff's (1985) typology.

Hence, hypothesis four:

HYPOTHESIS 4A: In a task involving an informated technology, subjects will express a significantly higher level of self-reported motivation than they will in a task involving an automated technology.

HYPOTHESIS 4B: In a task involving an informated technology, subjects' performance will be significantly lower than on a task involving an automated technology.

METHOD

Subjects

Participants were 375 students enrolled in an undergraduate principles of management course at Texas A&M University. The students received extra course credit for participating in this research.

Task

The task used in this study was a scholarship award task. Subjects, regardless of condition, reviewed a list of fifteen scholarship candidates and then performed an operation which calculated point totals for each candidate. They applied a cut-off score to the point totals to determine the ten scholarship recipients. Subjects then processed a Scholarship Diversity Form for each scholarship group, noting the ethnic and gender mix of the scholarship recipient group. Subjects then went on to the next group of fifteen scholarship candidates. The subjects worked on the task for twenty minutes.

Design

The manipulations involved in this experiment were information technology and discretion. Information technology was manipulated by the presence or absence of a computer. Discretion was manipulated by the high or low decision-making ability allowed for while performing the task. This 2X2 design resulted in four conditions. These conditions are described below.

<u>The automated task</u>. In this condition the information technology was present but discretion was absent. This task required the subject to look over the list of fifteen

scholarship candidates displayed on the computer screen in front of them. The subject was allowed to see the weights assigned to the three candidate variables: Scholastic Aptitude Test (SAT), grade point average (GPA), and Activities (ACT). The subject then pushed a button which advanced to the next screen and displayed a blank scholarship recipient box. The subject then pushed two buttons simultaneously which calculated the total points for each candidate and applied the cut-off score which produced the ten recipients. These ten recipients were displayed in the scholarship recipient box. Then, the subject hand processed a Scholarship Diversity Form for the group of recipients and moved on to the next group of candidates.

The informated task. In this condition both information technology and discretion were present. This task required the subject to look over the list of fifteen scholarship candidates displayed on the computer screen in front of them. The subject determined the weights assigned to the three candidate variables: SAT, GPA, and Activities. The subject then pushed a button to advance to the next screen which displayed a blank scholarship recipient box. The subject then pushed two buttons simultaneously which calculated the total points for each candidate and applied the cut-off score which produced the recipients. If ten recipients were not selected, the subject had to return to the first screen and adjust the weights and/or the cut-off score. Also, because all subjects were given instructions that there was a policy of diversity for this scholarship, the subjects could also return to the first screen and adjust weights and cut-off scores to produce a better ethnic and gender mix. Once ten satisfactory recipients were displayed in the scholarship recipient box, the subject processed a Scholarship Diversity Form for the group of recipients and moved on to the next group of candidates.

The manual with discretion task. This condition had information technology absent and discretion present. This task required the subject to look over the list of fifteen scholarship candidates displayed on a form in front of them. The subject determined the weights assigned to the three candidate variables: SAT, GPA, and Activities. The subject then hand-calculated the total points for each candidate and applied the cut-off score which produced the ten recipients. If ten recipients were not selected, the subject had to go back and adjust the weights and/or the cut-off score. Also, because the subjects were given instructions that there was a policy of diversity for this scholarship, the subjects could also adjust weights and cut-off scores to produce a better ethnic and gender mix. Once ten satisfactory recipients were selected, the subject processed a Scholarship Diversity Form for the group of recipients and moved on to the next group of candidates.

The manual task. In this condition both technology and discretion were absent. This task required the subject to look over the list of fifteen scholarship candidates displayed on a form in front of them. The subject was able to see the weights assigned to the three candidate variables: SAT, GPA, and Activities. The subject then hand-calculated the total points for each candidate and applied the assigned cut-off score which produced the ten recipients. Then, the subject hand processed a Scholarship Diversity Form for the group of recipients and moved on to the next group of candidates.

Procedure

Subjects were randomly assigned to one of the four conditions. Subjects entered the laboratory in groups of three and were trained to perform the randomly selected task for Time 1. Subjects were run in groups of three primarily due to equipment limitations. At each administration, all subjects were in the same experimental condition. To start, all subjects were together in the training room with the experimenter. The three subjects were not allowed to speak to each other. After the ten minute training session, each subject was assigned an individual workstation. The individual workstations were separate rooms where they could not see or hear any other subject. The subjects then worked on Trial 1 for twenty minutes and then completed a measurement instrument. The subjects were then trained to perform the task for Trial 2. After the subjects performed the second twenty minute trial, the subjects completed the final measurement instrument. Subjects were individually debriefed and excused from the laboratory.

Measures

Job Dimensions. An adapted version of the Multidisciplinary Job Design Questionnaire (MJDQ) (Campion, 1988) was administered. The adapted questionnaire was designed to assess the motivational dimension of the tasks. Prior research suggested the measure has favorable psychometric qualities (Campion, 1988), and convergent and discriminant validity (Campion, Kosiak, & Langford, 1988) with the popular Job Diagnostic Survey (Hackman & Oldham, 1976). The self-report MJDQ has provided evidence of convergent validity (r= .76) between the motivational score and the total score of the JDS.

Task Performance. Performance was measured as the actual number of completed Scholarship Diversity Forms.

RESULTS

Manipulation Checks

A manipulation check was conducted for each subject after they completed both the Time 1 and Time 2 task. A single question assessed if subjects realized they had task discretion. At Time 1, 94% of the subjects correctly answered the manipulation question. At Time 2, 94% of the subjects correctly answered the manipulation question. In sum, the manipulation of the discretion characteristic of the task was quite strong. The information technology manipulation (i.e., computer versus manual) did not require a manipulation check.

Tests of Hypotheses

For the purposes of the regression analyses, the discretion variable was dummy coded 1, 0 for the groups with and without discretion, respectively. In addition, the technology variable was coded 1, 0 for the computer and manual groups, respectively. Table 1 contains the cell means, standard deviations, and intercorrelations for the dependent variable for both the Time 1 and Time 2 Discretion by Technology design. Hierarchical regressions were used to test hypotheses 1-3. These regressions consisted of regressing the dependent variables (either motivation or performance) on the dummy coded technology and discretion variables in Step 1 and the technology by discretion variable in Step 2. Thus, hypotheses 1 and 2 were tested in Step 1 and Hypothesis 3 was tested in Step 2. Hypotheses 1 and 2 are supported if the step explained a significant amount of variance and their respective beta weights are significant. Hypothesis 3 is supported if a significant amount of variance is explained in Step 2 and if the beta weight of the interaction term is significant. Hypothesis 4 is supported if there is a significant difference between the automated and informated conditions.

Table 1
Means, Standard Deviations, and Inter Correlations Among the Experimental Variables

	Mean	SD	1	2	3	4	5	6	7	8
1. Motivation (T1)	2.96	1.17	(.88)							
2. Performance (T1)	6.89	7.79	-.48							
3. Information Technology (T1)[a]	.50	.50	-.18	.56						
4. Discretion (T1)[b]	.50	.50	.51	-.55	-.01					
5. Motivation (T2)	3.13	1.21	.34	-.05	-.06	-.09	(.89)			
6. Performance (T2)	8.30	9.08	-.06	.17	.05	-.05	-.45			
7. Information Technology (T2)[a]	.50	.50	-.04	.03	.13	-.01	-.12	.61		
8. Discretion (T2)[b]	.50	.50	.01	-.06	-.01	.01	.54	-.52	-.01	

Note: N= 375. r>.12, $p \leq 05$; r>.17, $p \leq .01$. (T1) = Time One. (T2) = Time Two

[a]Dummy coded, with technology = 1, without = 0.

[b]Dummy coded, with discretion = 1, without = 0.

Internal consistency reliability's are shown in parentheses on the diagonal.

Hypothesis 1A stated that a task which involves discretion would positively affect subjects' perceived motivation relative to a task with little or no discretion. This hypothesis was tested by regressing subjects' perceived motivation level on the dummy coded discretion variable. Table 2 displays the regression results. This test was conducted at both Time 1 and Time 2. The fact that both tests were significant argues strong support for this hypothesis.

Hypothesis 1B stated that a task which involves discretion would negatively affect individual task performance. This hypothesis was tested by regressing subjects' performance level on the dummy coded discretion variable. Table 3 displays the regression results. This test was conducted at both Time 1 and Time 2. Time 1 results were significant, however, Time 2 results were not significant which argues for partial support of this hypothesis.

Table 2
Regression Results from Regressing Motivation T1 and Motivation T2 on Discretion and Information Technology

Variable	**Motivation (T1)**			**Motivation (T2)**		
	Δr^2	**β^a**	**F**	**Δr^2**	**β^a**	**F**
Step 1	**.28***			**.30***		
1. Discretion		**1.18***	**131.06***		**1.29***	**150.87***
2. Information Technology		**-.42***	**16.48***		**2.28***	**7.70***
Step 2	**.02***			**.02***		
3. Discretion X Information Technology		**.56***	**7.59***		**.75***	**12.98***
Total	**r^2=.30***			**r^2=.32***		

Note: N = 367.
(TI) = Time One. (T2) = Time Two.
Δr^2 = change in r-squared
[a]Beta Weights and their significance are reported for the steps in which they entered.
*** p<.01.**

Hypothesis 2A stated that a task which involves the use of information technology would negatively affect subjects' levels of perceived motivation when compared to a task performed without information technology. This hypothesis was tested by regressing subjects' self-reported level of motivation on the dummy coded technology variable. Table 2 displays the regression results. This test was also conducted at both Time 1 and Time 2. The fact that both tests were significant suggests strong support for this hypothesis.

Hypothesis 2B stated that a task which involves the use of information technology would positively impact individual task performance. This hypothesis was tested by regressing subjects' performance level on the dummy coded technology variable. Table 3 displays the regression results. This test was conducted at Time 1 and Time 2. The fact that both tests were significant suggests strong support for this hypothesis.

Table 3
Regression Results from Regressing Performance T1 and Performance T2 on Discretion and Information Technology

	Performance (T1)			Performance (T2)		
	Δr^2	β^a	F	Δr^2	β^a	F
Step 1	.63*			.65*		
1. Discretion		-.85*	123.91*		-.24*	.94
2. Information Technology		1.03*	8.30*		1.10*	1964.08*
Step 2	.21*			.24*		
3. Discretion X Information Technology		-.79*	486.89*		.85*	776.86*
Total	r^2=.84*			r^2=.89*		

Note: N = 370
(TI) = Time One. (T2) = Time Two.
Δr^2 = change in r-squared
[a]Beta Weights and their significance are reported for the steps in which they entered.
* p<.01.

Hypothesis 3A stated that the relationship between IT and the perceived motivational dimension of a task is moderated by the level of task discretion such that the negative impact of information technology on perceived motivation would be stronger when discretion is low relative to when discretion is high. This hypothesis was tested

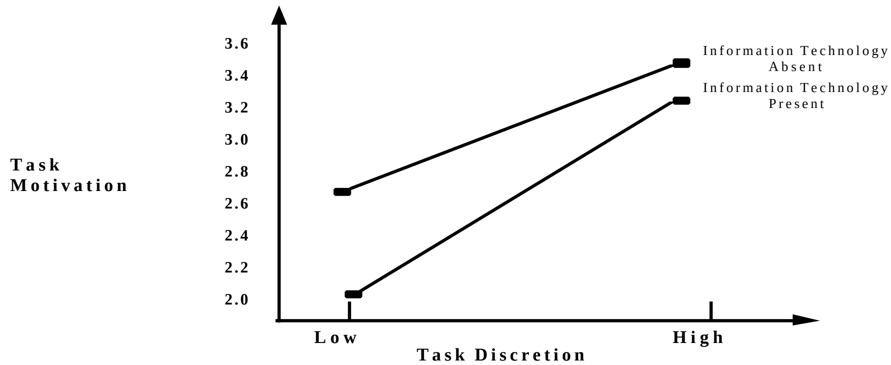

Figure 2: ***Depiction of the Interaction Between Information Technology and Discretion in Determining Perceived Level of Task Motivation at Time 1.***

using multiple regression where subjects' self-reported motivation was regressed on the dummy coded discretion variable, the dummy coded technology variable, and the discretion by technology interaction term. Table 2 displays the regression results. This test was conducted at both Time 1 and Time 2 and was significant at both time conditions.

As can be seen in Table 2, at Time 1, discretion and information technology explained 28% (p<.01) of the variance and the discretion by information technology interaction explained an incremental 2% (p<.01) of the variance in task motivation. At Time 2, discretion and information technology explained 30% (p<.01) of the variance and the discretion by information technology interaction explained an additional 2% (p<.01) of the variance in task motivation. The significant interaction term, at both Time 1 and Time 2, provides strong support for the notion that task discretion moderates the relationship between information technology and subjects' perceived motivation level. The nature of these interactions are plotted in Figure 2 and Figure 3, respectively. These interactions indicate that when task discretion is high, there is no significant impact of information technology on motivation. However, when discretion is low, there is a significant negative impact of information technology on task motivation.

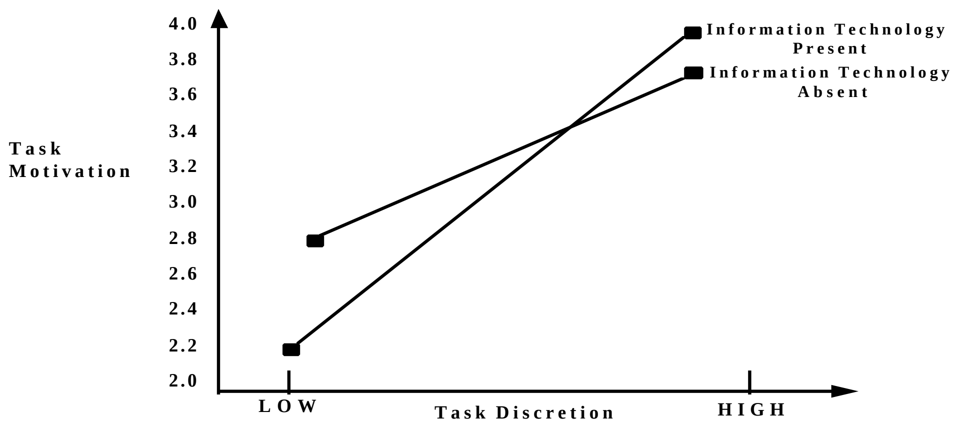

Figure 3: ***Depiction of the Interaction Between Information Technology and Discretion in Determining Perceived Level of Task Motivation at Time 2.***

Hypothesis 3B stated that the relationship between information technology and the performance of a task is moderated by the level of task discretion such that the positive impact of information technology on performance will be stronger when discretion is low relative to when discretion is high. Table 3 displays the regression results.

As can be seen in Table 3, at Time 1, discretion and information technology explained 63% ($p<.001$) of the variance and the discretion by information technology interaction explained an incremental 21% ($p<.001$) of the variance in task performance. At Time 2, discretion and information technology explained 65% ($p<.001$) of the variance and the discretion by information technology interaction explained an additional 24% ($p<.001$) of the variance in task performance. The fact that the interaction term is significant at both Time 1 and Time 2 provides strong support for this hypothesis. The nature of these interactions are plotted in Figure 4 and Figure 5, respectively. These interactions indicate that when task discretion is low there is a greater positive impact of information technology on task performance than when task discretion is high.

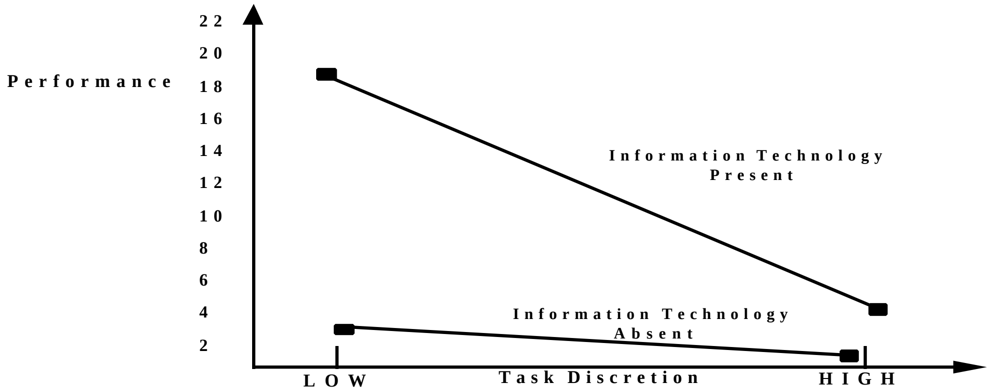

Figure 4: ***Depiction of the Interaction Between Information Technology and Discretion in Determining Performance at Time 1.***

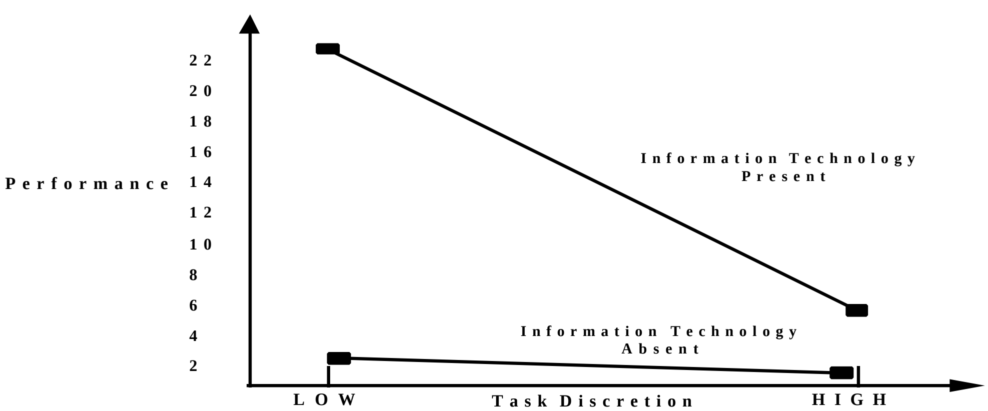

Figure 5: ***Depiction of the Interaction Between Information Technology and Discretion in Determining Performance at Time 2.***

Hypothesis 4A stated that subjects performing a task involving an informated technology will self-report higher levels of motivation than they would performing the same task involving an automated technology. This hypothesis was tested using a T-test procedure. Table 4 displays the result. The significant results at both Time 1 and Time 2 provides strong support for this hypothesis.

Table 4
Direct Test Results at Time 1 and Time 2 of the Motivational and Performance Difference Between An Automated and Informated Type of Information Technology

		Time 1 (T1)			Time 2 (T2)		
Variable		**M**	**dF**	**t-value**	**M**	**dF**	**t-value**
Motivation	**(Automate)**	**2.05**	**182**	**-9.89***	**2.15**	**186**	**-11.79***
	(Informate)	**3.51**			**3.82**		
Performance	**(Automate)**	**18.99**	**187**	**24.97***	**22.80**	**188**	**30.11***
	(Informate)	**3.43**			**4.62**		

Note. N = df+2
*** p<.001**

Hypothesis 4b stated that subjects performing a task involving an informated technology would report lower levels of performance than they would performing the same task involving an automated technology. This hypothesis was tested using a T-test procedure. Table 4 displays the result. The significant results at both Time 1 and Time 2 provides strong support for this hypothesis.

DISCUSSION

The results of this research strongly support the notion that there are at least two distinct types of information technology that affect subjects' motivation and actual performance on a task. At a minimum, the results of this research suggest that Zuboff's (1988) qualitative case analyses of different types of information technology holds true in a controlled laboratory experiment using empirical analyses. Beyond the formal testing of the automate and informate distinction, it may be argued that closer examination reveals a potential answer to "why" there is a qualitative and a quantitative difference between these two types of information technology.

First, hypothesis 1A was used to replicate the widely accepted theory of job design which states that the more enriched a job, the greater the level of motivational potential inherent in a task (Hackman & Oldham, 1976; 1980). This test was conducted to show that the laboratory manipulations were adequate. The significant result of this test supported job design theory as it exists today (Griffin & McMahan, 1995). Additionally, hypothesis 1B explored the task complexity argument that a more complex task would not necessarily lead to greater task performance. The partial support of hypothesis 1B provides evidence that, in a manual environment, greater task complexity may tend to reduce performance output.

Secondly, hypothesis 2A was specifically concerned with the impact of information technology on the task. As Pierce (1984) argued, individuals will perceive and describe their jobs as routine and boring when they interact with an information system technology. The test of this hypothesis strongly supports this contention. Information technology, applied unaltered, had a significant negative effect on an individuals' perceived motivational level of the task they were performing. Hypothesis 2B strongly supported the contention that information technology alone can improve performance. The support of hypothesis 2B upholds the argument that information technology is a very powerful tool that can radically enhance output performance.

Finally, hypothesis 3A suggested that the relationship between information technology and the motivational job dimension was moderated by task discretion. When task discretion was high, there was no significant impact of information technology on motivation as both manual and information technology conditions reported equal levels of motivation. However, when discretion was low, there was a significant negative impact of information technology on task motivation. This finding is critical from a job design perspective. As jobs are continually altered by the introduction of information technology, it is important to consider the effects on the motivational dimension of the work. A job that is merely simplified by information technology, may prove to be so "simple" that the work is considered very routine and boring by an employee. By not enriching the work, individuals on the job may sense only the control and continuity elements of the technology, and become less motivated due to the simplistic and meaningless tasks that remain to be performed.

Hypothesis 3B supported the view that discretion moderated the information technology and performance relationship to a lesser degree when discretion is low, relative to when discretion is high. This finding provides evidence of the trade-off in the use of performance enhancing tools such as information technology. If discretion is high, performance will decline compared to a situation where discretion is low and the job may be quite "roboticized." The challenge with the introduction of information technology may well be the ability to make substantial efficiency gains without completley "gutting" the motivational aspects of the work.

Taken together, these results support the argument that different types of information technology can have different effects on an individual's motivation and performance in performing a task. Additionally, the study directly tested the difference between an automated information technology and an informated information technology. The automated information technology was defined as a task which uses an information technology and has little or no discretion. The informated technology was defined as a task which uses an information technology and has a high level of task discretion (Zuboff, 1985; 1988). Significant results at both Time 1 and Time 2 provides strong support for the empirical difference between the two types of technology on both motivational and performance dimensions.

Thus, by independently manipulating both technology and discretion, we showed that Zuboff's (1988) automate/informate distinction is in large part a high versus low discretion distinction. Thus, these results imply that it may not be the technology itself, but how it is used (i.e., the discretion) that has the largest impact on task motivation and performance.

This study also contributes to the ongoing debate over trade-offs between job design models. In Campion's work (e.g., 1988; 1989) the author focused on the trade-offs between the motivational and mechanistic models of job design. In fact, Campion and McClelland

(1991) found that redesigning 11 clerical jobs consistent with the motivational approach resulted in higher satisfaction, less mental overload, greater chances of catching errors, and higher customer service. However, the change in design also resulted in increased training requirements, basic skills, and compensable factors. Despite the results of this study, the authors encouraged optimism that such trade-offs may not be absolute. Campion and McClelland (1993) in their follow-up study on enlarged jobs, stated that motivational and mechanistic models do not have to be negatively related to each other and can both be positively related to some outcomes. However, the findings here suggest that the trade-offs between motivational characteristics and actual performance are negatively related in an information technology environment.

Finally, as the study and findings of an expanded job design literature continue to provide direction to practicing managers, performance as an actual outcome measure takes on an extremely important role. This study contributes actual performance as an outcome measure that is, for the most part, absent from Campion's interdisciplinary model of job design (Campion & Thayer, 1985; 1987).

LIMITATIONS AND FUTURE DIRECTIONS

As with any research endeavor there are both strengths and weaknesses in the manner in which studies are conducted. A major strength of this research was the use of the behavioral laboratory that served to control for environmental variables and allowed for a rigorous test of the motivational and performance effects of information technology (Locke, 1986). Since research in this area is still in its infancy (Attewell & Rule, 1984; Parsons, 1988), the use of the behavioral laboratory is quite appropriate. A second strength of the research was the empirical test of the heretofore qualitative assessment of the different types of information technology as defined by Zuboff (1982; 1985; 1989). The use of the automate-informate distinction has become quite popular in the business press (i.e., Mankin, Cohen, & Bikson, forthcoming; Walton, 1989) and was subjected to quantitative research scrutiny by this research.

A limitation of this study may be the simple conceptual model itself. The variables and their relationships may be somewhat incomplete. The current model therefore required less sophisticated empirical tests than some may prefer. But again, the infancy of this area of organizational behavior research allowed for more basic questions to be asked. Another weakness may be the unnatural task setting of the behavioral laboratory. Thus, there should be caution in generalizing these results to different settings. However, this team of researchers strongly believe in the appropriateness in testing basic motivational and performance effects in a laboratory as a fundamental step in a programmatic research stream that will eventually involve individuals in a natural work setting (Ilgen, 1986).

This research assumed a static model of the environment with regard to information technology, motivation, and performance. Future research should examine changes in motivation and performance when jobs are redesigned and an important part of that redesign is changes in information technology. Empirical investigations in this vein can inform both the job design and organization change literatures. Future research should also explore extending the current research model presented here to include environmental variables (e.g., social cues). Also, well designed field investigations of the effects of information technology on jobs is required.

The continued investment in and use of new information technologies seems to be a certainty in the future production of goods and services. The "reengineering" (Hammer & Champy, 1993) of American business is arguably well underway and a critical component of this concept is the effective use of information systems. Therefore, through the research results summarized above, future investigations of questions concerning information technology will be enhanced.

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AUTHOR'S NOTES

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