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COMPUTER-BASED PERFORMANCE MONITORING AND PRODUCTIVITY IN A MULTIPLE TASK ENVIRONMENT

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ABSTRACT: Computer-based performance monitoring (CPM) provides managers with the ability to continuously, and unobtrusively, monitor the work performed by their employees. This paper examines the impact that CPM has on productivity when people are monitored on only a portion of the work that they perform. In a simulated work setting, subjects worked on two computerized tasks, and were led to believe that their work on one, both, or none of the tasks would be electronically monitored. People who were monitored only on a relatively simple task tended to work at a faster rate on both their monitored and non-monitored tasks, in comparison to people who were not monitored at all. People who were monitored only on a task that was more moderate in level of difficulty did not work any faster or more accurately than people who were not monitored. The results of the current study suggests that under certain conditions, employees may not discriminate between monitored and non-monitored work. Recommendations are offered to managers who are considering implementing CPM in their workplace.

Monitoring employee performance is a managerial behavior that can have a significant influence on productivity. Managers monitor their subordinates' performance by watching employees work, inspecting the products of their labor, examining performance-related documents, and asking employees to provide self-reports about their progress (Larson & Callahan, 1990). Managers often engage in monitoring because it helps them provide objective feedback to employees, to reward achievement, and to engage in goal-setting (Sherizen, 1986; Smith, 1988).

The consequence of this activity can be measured in terms of em-

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ployee productivity. For example, one study found that effective managers (i.e., those with high performing employees) spent nearly twice as much time monitoring their subordinates' performance as ineffective managers (Komaki, 1986). To explain these findings, Larson and Callahan (1990) suggest that monitoring provides cues to employees about the relative importance of the work they perform. Therefore, managers who monitor more often send a stronger message to employees about the worth of their work and the amount of effort they should exert than managers who monitor less frequently.

A relatively new development in the workplace, that provides managers with the ability to increase the extent to which they monitor, is the use of computer-based performance monitoring (CPM) systems. CPM refers to the practice of using computer technology to collect, store, analyze, and report information about employee performance. CPM systems allow managers to "tap into" their employees' computer terminals, and observe the pace at which employees are working, their level of accuracy, and the amount of time spent on productive and non-productive tasks. CPM systems can be used to evaluate the real-time performance of employees, as when managers view the computer screen that an employee is working on via their own (the manager's) terminal. Additionally, they can be used to accumulate performance statistics for managers to review at some later point in time, as when number of keystrokes or transactions completed is electronically recorded for each employee. CPM systems also can be configured to generate a continuous accounting of employees' work or to record and evaluate periodic work samples (U.S. Congress, Office of Technology Assessment, 1987).

The use of CPM systems in the workplace is increasing at a rapid rate. In 1987, one study found that between 25 and 35 percent of all clerical workers in the United States were evaluated using electronic measures (U.S. Congress, 1987). Between 1990 and 1992, U.S. companies spent over $500 million on employee surveillance software. By 1996, that expenditure is expected to exceed $1 billion (Bylinsky, 1991; Halpern, 1992).

Some recent research has examined the impact that CPM has on productivity in the workplace. For example, Grant and Higgins (1989) surveyed 1,500 computer-monitored and non-monitored employees working for 50 Canadian service firms, and found that the more tasks companies monitored, the more their employees valued production. Unfortunately, this study did not measure the degree to which valuing production affected actual productivity. Other research suggests that production quantity, but not necessarily production quality, may increase when CPM systems are used. For example, Grant, Higgins, and Irving (1988) reported that when only quantitative aspects of a job were monitored by computer, employees responded by increasing production quantity and sacrificing production quality. Errors also are likely to increase when incentive systems tied to monitoring result in excessive increases in workload (Amick & Smith, 1992). However, this focus on quantity over quality is not inevitable. For example, in a case study, Griffith (1993) reported how one organization successfully integrated a CPM system, specifically designed to help enhance production quality, into their microchip inspection process. The system allowed supervisors to monitor in "real-time" and from their own offices the work that their employers were conducting at a series of micro-chip inspection stations. The CPM system also created a record with information pertaining to the inspection of each micro-chip, that could be reviewed later for verification and training purposes.

In another organization, a CPM system was installed to monitor the work performed by a group of insurance claims processors. The system was designed to assess the rate at which these employees performed a clerical task, but did not record information about a customer service function that they also performed. Irving, Higgins, and Safayeni (1986) surveyed 50 of these insurance claims processors and compared their survey responses to those provided by 94 employees who performed comparable jobs in non-CPM organizations. The computer monitored employees reported that they produced a greater quantity of work and perceived that their work group was more productive than the non-monitored employees. However, it appears that this increase in productivity was achieved at the expense of non-monitored work activities. The computer-monitored employees reported that they spent more time and effort working on their monitored clerical tasks and less time working on their non-monitored customer service responsibilities. That is, consistent with Larson and Callahan's (1990) information processing explanation, CPM appeared to provide a cue to employees about which tasks were more important (the monitored, clerical tasks) and which tasks were less important (the non-monitored, customer service tasks).

Other research suggests that employees sometimes fail to discriminate between monitored and non-monitored tasks. For example, one study (Tamuz, 1987) examined the accuracy of airline pilots' self-reports of near-miss accidents after a computerized system was installed that could detect some, but not all, types of near-misses. The pilots increased their reporting of monitored near-misses, as well as their reporting of near-misses that could not be detected by the system. Tamuz explained that monitoring created a heightened awareness that generalized beyond the monitored task to a non-monitored function.

A variety of factors might help explain why employees sometimes discriminate between monitored and non-monitored tasks, and why the effects of CPM sometimes generalize beyond monitored functions to non-monitored ones. For example, when compensation and other rewards are significantly determined by performance on monitored tasks and less so by performance on non-monitored tasks, employees probably will focus on monitored functions at the expense of non-monitored ones. In contrast, less discrimination may be found when a weaker association exists between performance on the monitored task and some reward. Employees also may be more likely to discriminate between a monitored and non-monitored task when the tasks are highly dissimilar (e.g., data entry and customer service) than when they are quite similar (e.g., reporting one class versus another class of near-miss accident). Additionally, employees may be more apt to discriminate when they are free to allocate their time between monitored and non-monitored tasks. In contrast, when the amount of time employees spend on each task is externally controlled, less discrimination behavior may be observed.

Unfortunately, it is difficult to find evidence that supports any of these explanations from studies that are conducted in field settings. Most of this research relies exclusively on self-report data collected from employees and their supervisors rather than on the inspection of objective productivity records (e.g., Irving, Higgins, & Safayeni, 1986). In these cases, reported increases and decreases in productivity may reflect organizational expectations that performance will change more than any actual change in productivity. Even when objective measures of pre- and post-implementation performance are available, it often is difficult to ascertain whether increases and decreases in productivity should be attributed to CPM or to other managerial changes that were implemented concurrently with CPM. For example, many companies introduce feedback and contingent reward systems at the same time their CPM systems are installed (Aiello & Kolb, in press). Although it is important to understand the joint effects of these factors, it also is critical to examine the independent impact that CPM has on productivity (Goodman & Fenner, 1988).

To help address this issue, several laboratory studies (e.g., Aiello & Svec, 1993; Chomiak, Kolb, & Aiello, 1993) have been conducted that examine CPM's impact on task performance. These studies allow us to explore the effects of CPM while holding constant management style, reward structure, and work climate variables. Consistent with data that has been collected in field settings, this research shows that CPM does influence productivity, although not always in a positive direction. In a series of studies, Aiello and his colleagues (Aiello, DeNisi, Kirkhoff, Shao, Lund, & Chomiak, 1991; Aiello & Kolb, 1995; Aiello & Shao, 1992; Aiello & Svec, 1993; Chomiak, Kolb, & Aiello, 1993) had laboratory subjects work either on simple data entry tasks or difficult anagram solving tasks on personal computers. Some subjects were led to believe that their task performance could be monitored by a study supervisor via a remote "master" computer, while others believed that the supervisor could not monitor their work. These studies consistently found that monitored subjects outperformed non-monitored subjects on easy tasks; however, non-monitored subjects outperformed monitored subjects on difficult tasks.

Aiello and his colleagues (c.f., Aiello & Kolb, 1995; Aiello & Svec, 1993) argue that the effects of CPM can be understood using a social facilitation framework. Social facilitation refers to the phenomenon whereby people perform simple, well-learned tasks better when they work in the presence of others, and in contrast perform difficult, less well-learned tasks better when they work alone (Zajonc, 1965). According to the social facilitation perspective, computer-monitored employees should be more productive than non-monitored employees when their work on simple tasks is observed, and less productive when their work on complex tasks is observed. Because most companies currently use CPM systems to monitor employees who perform work that is repetitive and relatively simple in nature (U.S. Congress, 1987), it is not surprising that most field studies (e.g., Irving, Higgins, & Safayeni, 1986) have found that productivity rises when CPM is introduced. However, laboratory data suggests that productivity may suffer when employees who perform tasks that they have not yet mastered are electronically monitored.

To date, however, none of these laboratory studies have examined the impact that CPM has on performance when only some, but not all, of the tasks subjects work on are monitored by computer. The study presented in this paper addresses this gap by examining the impact that CPM has on productivity in a multiple task environment. Subjects worked on two relatively similar tasks, one of which was fairly simple and the other of which was more moderate in level of difficulty. Some subjects were monitored via computer on only one task, some were monitored on both tasks, and some were not monitored at all. In contrast to procedures used in field research, no explicit rewards were provided to subjects, thus eliminating the degree to which differences in compensation could confound the results. Additionally, in the current study the amount of time subjects could allocate to monitored and non-monitored tasks was controlled. This allowed us to explore the possibility that job design variables, such as machine versus human pacing, have an impact on whether or not employees differentially allocate resources to computer-monitored versus non-monitored tasks. And finally, because subjects worked on tasks that varied in level of difficulty, the study allowed us to examine the degree to which task difficulty influenced these effects. The paper concludes by offering recommendations to employers who are considering introducing CPM systems into their organizations.

THE EFFECTS OF CPM IN A MULTIPLE TASK ENVIRONMENT

This study examined the following hypotheses related to CPM and productivity.

H1. Consistent with the information processing perspective, subjects were expected to be more productive when their work was monitored than when it was not monitored, because monitoring was expected to communicate information about the importance of the work that was being performed.

H2. Consistent with research related to social facilitation, computer monitoring was expected to have a stronger (positive) impact on performance on the simple task than on performance on the task that was more moderate in level of difficulty.

Additionally, this study examined two competing hypotheses related to monitoring only one, but not both, tasks.

H3. Consistent with the perspective that monitoring provides information about which tasks are more important and which are less important, partially monitored subjects were expected to discriminate between their monitored and non-monitored tasks. That is, when subjects were monitored on only one task, it was possible that they would be more productive (than non-monitored subjects) on the monitored task, but not any more productive (than non-monitored subjects) on the non-monitored task.

H4. In contrast, it was also possible that the effects of monitoring would generalize beyond the monitored task to the non-monitored task. That is, when subjects were monitored on only one task, they could be more productive (than non-monitored subjects) on both the monitored and the non-monitored task. These results could occur because subjects worked in the absence of any explicit reward system that was tied to monitoring, because the two tasks they worked on were highly similar rather than dissimilar, and because the amount of time that they could allocate to each task was externally controlled.

Design

Subjects performed two somewhat similar tasks on a personal computer: a simple data entry task, and a vowel/consonant identification task that was more moderate in level of difficulty. Subjects' beliefs about whether or not their work was electronically monitored was systematically manipulated. Some subjects were led to believe that all of their work would be monitored by the study supervisor, other subjects were told that their work on only one task would be monitored, and still others were led to believe that their task performance would not be monitored at all.

Subjects

One hundred and fifty-one introductory psychology students attending a large, northeastern university participated in the study, for which they received partial course credit. Of these, data from 27 subjects were discarded for the following reasons: computer malfunction (7 subjects); correctly guessed purpose of study (3 subjects); responded incorrectly to manipulation check regarding monitoring condition (10 subjects); and failed to follow instructions regarding how to perform both tasks (7 subjects). Data obtained from the remaining 124 subjects are presented in this manuscript.

Design and Procedure

Subjects were randomly assigned to one of eight test conditions. Four levels of performance monitoring were crossed with two levels of task order, resulting in a 4×2 factorial design.

All subjects performed two somewhat similar, computerized tasks: a simple data entry task, and a slightly more difficult vowel/consonant identification task. In the data entry task, subjects merely keyed six-digit random numbers from a worksheet into a computer. In the vowel/consonant identification task, subjects had to decide whether random letters were vowels or consonants and then indicate their selection by keying appropriate six-digit random numbers into a computer. Subjects practiced each for four minutes, with half working on the data entry task first, and half working on the vowel/consonant task first. Practice scores were recorded for each subject, for use as a baseline score in later statistical analyses.

Following practice, subjects were informed that 1) their subsequent work on the data entry task, but not the vowel/consonant task, would be monitored via computer by the study supervisor; 2) their subsequent work on the vowel/consonant task, but not the data entry task, would be monitored via computer by their supervisor; 3) their subsequent work on both tasks would be monitored via computer by their supervisor; or 4) their subsequent work on both tasks would not be monitored. Six contiguous eight-minute work sessions followed in which subjects alternated three times between working on the data entry task and the vowel/consonant task (working in the task order established in the practice session). After subjects performed the data entry and vowel/consonant identification tasks, they completed a brief manipulation check questionnaire, and were debriefed.

Results

Manipulation Checks. On the post-experimental questionnaire, subjects responded to two questions regarding whether their work on the data entry task and the vowel/consonant task was monitored. 93% of subjects responded appropriately to both questions; however, ten of the original 151 subjects answered at least one of these questions incorrectly. As indicated previously, data for these ten subjects were discarded.

Subjects also responded to two questions in which they assessed the degree of difficulty associated with completing the two tasks. As expected, subjects perceived that the data entry task was fairly easy (M = 2.55, 1 = very easy, 7 = very difficult), and that the vowel/consonant task was more moderate in level of difficulty ($M = 3.52$), $t = 7.41$, $p < .0001$.

CPM and Productivity. The impact that CPM has on productivity was assessed using hierarchical regression. Initially, two dummy variables were created to account for the three types of performance monitoring (no tasks monitored, one task monitored, both tasks monitored), and to permit comparison to the non-monitored control group. Likewise, one dummy variable was created to reflect the two levels of task order. Three regression equations were created for each of the four dependent performance measures (total attempts on the data entry task, total entries keyed correctly on the data entry task, total attempts on the vowel/consonant task, and total entries keyed correctly on the vowel/consonant task). In the first regression equation, practice score and the dummy variables for task order and monitoring condition were entered as independent variables. In the second equation, two-way cross product terms were added to the variables included in the first equation. In the third regression equation, the three-way interaction between practice score, task order, and monitoring condition was added to the variables included in the second equation.

Contrary to expectations, this initial set of analyses did not detect a significant main effect for computer monitoring, all p's $< .10$. However, inspection of the performance means suggested that subjects who were monitored only on the data entry task performed quite differently than subjects who were monitored only on the vowel/consonant task (see Table 1). Therefore, a second set of regression analyses were performed in which three dummy variables were used to reflect four different variations of performance monitoring (no tasks monitored, only data entry task monitored, only vowel/consonant task monitored, and both tasks monitored). This set of analyses revealed that computer monitoring did have a significant influence on task performance (see Table 2).

Consistent with the hypothesis that productivity would be positively affected by computer monitoring (Hypothesis 1), Tables 1 and 2 show that subjects who were monitored only on the data entry task attempted and correctly keyed significantly more entries on the data entry task than subjects who were not monitored at all. Similarly, subjects who were monitored only on the vowel/consonant task attempted to key somewhat more entries on the vowel/consonant task than non-monitored subjects. However, consistent with the hypothesis that monitoring would have a stronger effect on simple task performance than on performance of a task that was moderate in level of difficulty, this difference was not significant.

Tables 1 and 2 also show that subjects who were monitored only on the data entry task tended to attempt and correctly keyed significantly more entries on the vowel/consonant task than the non-monitored control group. That is, the effects of monitoring data entry appeared to gen-

Table 1
Mean Post-Manipulation Performance Scores Adjusted for Practice Performance

		Monitoring Condition			
		None	DE	VC	Both
Data Entry Task Performance					
Attempts	*M*	339.74	352.90	338.36	337.94
	SE	4.42	4.49	4.65	4.15
Correct	*M*	320.66	334.54	325.42	323.01
	SE	4.88	4.95	5.13	4.59
Vowel/Consonant Task Performance					
Attempts	*M*	266.43	277.48	277.30	264.68
	SE	4.66	4.73	4.89	4.37
Correct	*M*	246.18	261.33	253.33	243.95
	SE	4.95	5.03	5.20	4.65

Note. Each column reports the four performance scores for subjects in a given monitoring condition. Each row reflects performance across the four monitoring conditions on a single performance measure. DE = Data Entry. VC = Vowel Consonant.

Table 2
Regression Analysis for Post-Manipulation Productivity

Data Entry Task Attempts[a] Independent Variable	*b*	*t*	*p*
Practice Attempts	5.68	34.71	.0001
Monitoring Condition			
DE vs. None	13.16	2.09	.05
VC vs. None	−1.37	.21	ns
Both vs. None	−1.80	.30	ns
Task Order	−14.78	3.34	.05

Data Entry Task Correct[b] Independent Variable	*b*	*t*	*p*
Practice Correct	5.55	31.03	.0001
Monitoring Condition			
DE vs. None	13.88	2.00	.05
VC vs. None	4.76	.67	ns
Both vs. None	2.34	.35	ns
Task Order	−17.09	3.49	.05

Vowel/Consonant Task Attempts[c] Independent Variable	*b*	*t*	*p*
Practice Attempts	5.95	23.77	.0001
Monitoring Condition			
DE vs. None	11.05	1.67	.10
VC vs. None	10.87	1.61	ns
Both vs. None	−1.75	.27	ns
Task Order	21.16	4.37	.0001

Vowel/Consonant Task Correct[d] Independent Variable	*b*	*t*	*p*
Practice Correct	5.68	22.37	.0001
Monitoring Condition			
DE vs. None	15.16	2.15	.05
VC vs. None	10.16	1.41	ns
Both vs. None	−2.23	.33	ns
Task Order	21.03	4.05	.0001

Note: DE = Data Entry. VC = Vowel/Consonant
[a]Overall $R^2 = .91, p < .0001$.
[b]Overall $R^2 = .89, p < .0001$.
[c]Overall $R^2 = .83, p < .0001$.
[d]Overall $R^2 = .81, p < .0001$.

eralize to the non-monitored vowel/consonant task, providing evidence against hypothesis 3 and in support of hypothesis 4. However, this pattern was not replicated for the group that was monitored only on the vowel/consonant task. When subjects were monitored only on the vowel/

consonant task, they did not attempt or correctly key significantly more entries on the vowel/consonant task or the non-monitored data entry task.

Surprisingly, the performance of subjects who were monitored on both tasks did not differ from subjects who were not monitored at all. However, a significant main effect was detected for task order. Subjects obtained significantly higher scores on whichever task they performed first. None of the two-way or three-way interaction terms were significant.

DISCUSSION

This study showed that CPM can have a positive impact on productivity. Subjects who were monitored only on the data entry task attempted more entries and keyed more entries correctly on that task than subjects who were not monitored at all. These findings are consistent with the information processing approach to understanding monitoring, that predicts that monitoring influences performance because it communicates information about the importance of a task (Larson & Callahan, 1990). It also is consistent with the social facilitation perspective, that suggests that people will be more productive when they perform simple tasks in the presence of others than when they perform them alone (Zajonc, 1965).

Nonetheless, subjects who were monitored only on the vowel/consonant task did not perform any differently than subjects in the non-monitored control group. Because subjects reported that the vowel/consonant task was significantly more difficult to perform than the data entry task, these findings provide additional support for using the social facilitation framework to predict how CPM influences productivity. Social facilitation research predicts that people will be less productive when they perform difficult tasks (i.e., tasks that they have not yet mastered) in the presence of others than when they perform them alone (Zajonc, 1965). In this study, the vowel/consonant task was neither very simple nor very difficult. Therefore, it is not surprising that monitoring had neither an enhancing nor a debilitating effect on productivity on that task.

Thus, CPM appears to have a beneficial impact on productivity, but only when people are performing very simple, well-learned tasks. When tasks are more moderate in level of difficulty, or less-well learned, CPM does not appear to facilitate performance. Furthermore, past studies have shown that productivity may even suffer when performance on difficult tasks are electronically monitored (Aiello & Shao, 1992; Aiello & Svec, 1993). This suggests that organizations should consider the complexity of the work to be monitored, and the degree to which workers have mastered their jobs, when making decisions about implementing CPM in the workplace.

According to the information processing perspective, CPM influences productivity because it communicates to workers that the tasks they perform are important (Larson & Callahan, 1990). Thus, we might expect that workers who are only monitored on part of their work will discriminate between monitored and non-monitored tasks, expending more effort on monitored tasks at the expense of non-monitored ones. Nonetheless, in the current study subjects who were monitored only on the data entry task showed higher productivity on both their monitored and non-monitored assignments. In other words, the effects of monitoring appeared to generalize to the non-monitored task.

It is important to recognize that in the current study, certain conditions existed that may have facilitated this generalization behavior. First, the monitored and non-monitored tasks were quite similar to one another. Both involved keying six-digit numbers into a computer. Likewise, in field studies where generalization has been found, the monitored and non-monitored tasks have involved similar functions. For example, Tamuz (1987) found evidence of generalization when she compared pilots' self-reports of monitored near-miss accidents with their self-reports of non-monitored near-miss accidents. In contrast, when Irving, Higgins, and Safayeni (1986) found evidence of discrimination behavior in a sample of insurance claims processors, the employees' monitored (clerical) and non-monitored (customer service) tasks were quite dissimilar. Further laboratory research that manipulates task similarity is needed to confirm this observation. In the meantime, organizations that plan to monitor some, but not all, of the tasks an employee performs should consider the degree of similarity between monitored and non-monitored functions, when making their implementation decisions.

Second, in the present study, subjects were not provided with any explicit rewards that were tied to task performance. When people are rewarded (or not rewarded) equally for their performance on monitored and non-monitored tasks, they may fail to discriminate among them. However, when rewards are determined primarily by performance on monitored tasks, discrimination behavior may be more likely to occur. Additional research that manipulates the rewards attached to monitored versus non-monitored tasks would provide more insight regarding this issue.

Finally, in the present study, a computer program ensured that subjects spent an equal amount of time working on monitored and non-monitored tasks. However, in the workplace, employees often are free to differentially allocate the amount of time they spend working on each assigned task, and may partially base their allocation decisions on the presence or absence of monitoring. For example, in the study of insurance workers that was described earlier (Irving, Higgins, & Safayeni, 1986), the employees who were monitored on their clerical functions but not their customer service functions may have been free to employ tactics that reduced the length of time they spent on phone calls with clients, thereby allowing the employees to devote more time to monitored clerical functions. The implication is that under conditions of self-pacing, workers may discriminate between monitored and non-monitored functions. In contrast, under machine pacing conditions, fewer opportunities for discrimination may exist.

Of interest, in the present study, this generalization effect was detected only among subjects who were monitored on the simple, data entry task. Generalization did not occur among the subjects who were monitored only on the more moderate vowel/consonant task. In fact, monitoring the vowel/consonant task appeared to have no significant impact on performance whatsoever. And, surprisingly, subjects who were monitored on both the data entry and vowel/consonant tasks were not any more productive than subjects who were not monitored at all.

One study that examined social facilitation effects in a mixed-task environment may help explain these results. In this study (Bond, 1982), some subjects worked on a verbal learning task that contained predominantly simple items intermixed with a few complex ones, while other subjects worked on a list that contained mostly complex items intermixed with a few simple ones. Although one would expect that observation (i.e., monitoring) would lead to enhanced performance on the simple items, performance on these items actually suffered when they were embedded in a list consisting of mostly complex items. And, although one would expect that observation would lead to depressed performance on the difficult items, complex task performance remained unchanged when the difficult items were embedded in a list consisting of mostly simple items. In other words, task context moderated the effects of being monitored.

In the present study, being monitored on only one task may have created similar task context effects. That is, subjects may have focused their attention on the monitored task, leading to the phenomenological experience that they were working predominantly on the monitored task and that the non-monitored task was merely embedded within it. Thus, when subjects were monitored only on the vowel/consonant task, they may have had the experience of working predominantly on a task that was moderate in level of difficulty (vowel/consonant) that contained some simple elements (the data entry task). Because social facilitation effects would not be expected for a "neutral" (i.e., neither simple nor complex) task, subjects in this condition were unaffected by monitoring. In contrast, when subjects were monitored only on the data entry task, they may have perceived that they were working on a simple task that contained a complex task embedded within it. Therefore, they experienced both tasks as simple, and standard social facilitation effects were obtained. And finally, when subjects were monitored on both the simple and the more moderate task, it is possible that a "neutral" context was created, masking any social facilitation effect that might otherwise be found.

In summary, it appears that a variety of factors may influence the degree to which CPM influences productivity. The present study shows that when people are monitored on simple, well-learned tasks, productivity rises; however, when people are monitored on tasks that are more moderate in level of difficulty, no change in performance may occur. Additionally, when people are monitored on only some, but not all, of the tasks they perform, the facilitative effects of monitoring *can* generalize to non-monitored tasks. However, this may occur only when the monitored and non-monitored tasks are quite similar, rewards are not determined by performance on the monitored task, people are not free to differentially allocate their time between monitored and non-monitored assignments, and the monitored assignment is less complex than the non-monitored one. Additional research is needed to provide evidence supporting these hypotheses.

CONCLUSIONS

Both field and laboratory studies, such as the one presented in this paper, have demonstrated that CPM has an impact on productivity. In the workplace, companies may find that productivity improves when employees performing relatively simple and routine tasks are monitored electronically. However, they also may find that productivity decreases when employees who perform relatively complex tasks, or tasks that they have not yet mastered, are electronically monitored. In these instances, companies should consider the benefits they are attempting to obtain from the monitoring system, and weigh them against the changes in productivity that may occur when it is implemented.

Because most employees work on a variety of different tasks throughout the workday, organizations introducing CPM systems need to consider the impact of electronically monitoring only some, but not all, of the tasks their employees perform. In such cases, organizations may be concerned that employees will place undue focus on monitored tasks at the expense of non-monitored ones. However, the present study showed that the facilitative effect that CPM has on simple task performance can generalize to non-monitored tasks. Further research is needed to examine the precise conditions under which generalization or discrimination behavior is obtained.

Besides influencing productivity, a number of studies (e.g., Amick & Smith, 1992; 9to5, 1990; Rogers, Smith, & Sainfort, 1990) have found that employees who are monitored via CPM appear to experience more stress than employees who are monitored in other ways. Some of the stress associated with CPM may be attributable to its pervasiveness; employees who previously had a supervisor check in on them from time to time may experience distress when they learn that every minute of their workday can be observed by the CPM system. Research has also shown that stress is likely to result if companies inadvertently (or deliberately) reduce opportunities to receive social support, increase work load demands, and reduce opportunities to exercise control when CPM systems are implemented (Aiello & Kolb, 1995; Amick & Smith, 1992; 9to5, 1990; Rogers, Smith, & Sainfort, 1990). In response to concerns about the physical and emotional distress that may accompany CPM, Sweden has enacted legislation that restricts the degree to which companies can electronically monitor the work performed by individual employees. In the United States, legislation has been introduced that, if passed, would require companies to inform employees about CPM and other forms of electronic surveillance in the workplace, but would not generally limit its use (U. S. Congress, 1987).

Unfortunately, studies have not explored the long-term influence that CPM has on employee productivity and stress. For example, we may find that, over time, employees adapt to CPM so that it no longer has any impact on task performance or anxiety. Conversely, over time employees may become overwhelmed by the constant surveillance that CPM imposes. In this case, we may find that productivity begins to suffer as employees develop stress-related illnesses. To determine the long term impact that CPM has on productivity and stress, longitudinal studies need to be conducted. These well-controlled field studies can provide direction to managers who are considering adopting this new technology.

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