Chapter 2

Using Computers To Monitor Office Work

CONTENTS

Figures

Tables

Chapter 2

Using Computers To Monitor Office Work

INTRODUCTION

Electronic work monitoring is the computerized collection, storage, analysis, and reporting of information about employees' productive activities. Within this broad definition, the primary focus of this report will be on obtaining data about employees directly through their use of computer and telecommunication equipment. [1] This type of information gathering has been called "electronic monitoring, "electronic work measurement, " or "telephone monitoring. "2 This chapter will also include a discussion of "service observation, " the practice of listening in on conversations between employees and customers to evaluate the employees' courtesy or competence. Service observation is often used in conjunction with electronic work measurement for telephone operators and customer service workers.

Some people have warned that use of electronic monitoring leads to creation of electronic sweatshops. "Electronic sweatshop' '–the term conjures up images that combine the worst features of both the factory and the office: boring, repetitive, fast-paced work that requires constant alertness and attention to detail, all done under the pressure of constant supervision and demands for faster work. Worst of all, the supervisor isn't even human. Employees must labor at top speed under the view of unwinking computer taskmasters that record every item of work completed, along with every mistake, rest break, and deviation from standard practice. A person's job depends on the computer's comparison of performance to the standard. Interaction with fellow workers is impossible because of the pace of work; job satisfaction is low, and stress and stress-related health problems are the inevitable result of having to work under such conditions.

Electronic work monitoring is already a daily reality for millions of U.S. workers. They seem to be having varied experiences with it. Some view electronic monitoring as a useful tool that helps them get better control of their work, ensures that their supervisors give objective evaluations, and helps their company be more productive. Others believe they indeed do work in electronic sweatshops as described above, and that monitoring is an unfair surveillance used to control them. Still others have mixed feelings: they may not mind monitoring per se, but they feel it isn't being used in the fairest or most effective way.

Electronic monitoring is usually used in conduction with a work measurement system. Work measurement systems usually do four things. First, they set standards for the time it should take to produce certain units of work. Second, they monitor the actual time it takes to produce each unit of work. Third, they analyze the variance of the actual time from the standard. And finally, they provide data for use in planning, cost estimates, and productivity improvement. [3] As more employees use computers in their jobs, computer software is increasingly used to monitor actual performance, compare performance to standards, and provide planning data.

As more capabilities of the computer and telephone are being explored for office work, it is probably natural that some of the same capabilities are found useful in supervising work as well. Both work and supervision are becoming automated. Work done- on a com-

[1] This definition is very similar to one found in: Andrew Clement, "Electronic Management: The New Technology of Work Place Surveillance," Canadian *Information Processing Society Session 84 Proceedings*. Calgary, Alberta, May 9-11, 1984, pp. 2.59-266.

[2] In this chapter, "work measurement" is used to include the whole process of developing procedures and standards for job performance, collecting data on actual performance and comparing actual performance to standards. "Work monitoring" refers only to collection of information about actual performance

[3] SEW U.S. Department of Defense, Office of The I n.specter General, *Work Measurement Systems and Engineered Labor Standards* (Washington, DC: October 1986).

puter is very abstract. Many information workers no longer handle concrete items like documents, file folders, paper clips, orders, invoices, rubber stamps, or checks. Those physical objects have disappeared into the computer and have become abstract analogs of their former selves. The various stages of work that transform raw materials into final products take place inside the computer, too. A supervisor who could only observe the physical activity of people at their computer terminals, without knowing what was going on inside the computer, would know little about the work being done.

The tool that gives a picture of what is happening inside the computer is the computer itself. Computers' capacities for recording and storing information make it possible to keep detailed records about all aspects of the production process. And their ability to sort that information in different ways means that the information can be put to many uses.

Computer records can give a picture of the total performance of a work group, or a department. Statistics on historical patterns of production can be used to estimate future workloads, to plan for new personnel, or to justify new equipment. Performance statistics may also be compared with budgeted costs to determine the cost-effectiveness of an operation. Such complete and up-to-date information is necessary in a cybernetic model of management that requires immediate feedback to managers about current activities to be used as the basis of future decisions.

Computer work monitoring can also give information on individual performance. The focus of this chapter is computer monitoring of individual performance. Computer-generated statistics can be used as a tool to increase or maintain levels of employee performance. They may be used in individual personnel decisions —pay, promotion, retraining, and discharge. They can be a feedback tool to help employees gain more control of their own work; conversely, they can be used to limit employee decisions about the work process. Like most technological tools, work monitoring per se is neither bad nor good. Its effects depend on how it is used.

WHAT KIND OF WORK GETS MONITORED?

Most of the electronic monitoring found by OTA and other researchers affects office workers with short-cycle "production" jobs, that is, jobs where a limited number of standardized tasks are performed repeatedly to produce some information-based end-product. Most such jobs are considered clerical, for example data entry or insurance claims processing. However, monitoring can also be applied to professional jobs with a quantifiable output, for example computer programmers or insurance underwriters.

Data-entry jobs are perhaps the epitome of routine, standardized information-processing work. The operator reads information from a paper source and enters it on a keyboard or keypad to be recorded on computer tape or disk. Most key-to-disk and key-to-tape data-entry systems are equipped to count operator keystrokes, and in these high-production jobs, counting keystrokes is an obvious way to measure performance.

However, key entry is not the only job where production can be monitored electronically using computer counts. Table 1 lists some of the office jobs that are often subject to work measurement from production data gathered through electronic monitoring. The list is by no means exhaustive. The table summarizes a few of the aspects of work that can be electronically monitored for each job.

What do all the jobs in table 1 have in common? Why is it that they lend themselves to computer monitoring? Jobs that are subject to electronic monitoring are generally those that are subject to work measurement techniques. In work measurement systems, man-

Table 1.—Some Office Jobs Currently Subject to Electronic Work Monitoring

Job	What is measured	How obtained
Word processors	speed, errors, time working	keystrokes counted by computer
Data-entry clerks	speed, errors, time working	keystrokes counted by computer
Telephone operators	average time per call	each call timed by call distribution system
Customer service workers	time per customer number and type of transaction	each call timed by call distribution system, transactions counted by computer
Telemarketing/other sales	time per customer; sales volume	each call or transaction timed. sales tabulated by computer
Insurance claims clerks	number of cases per unit time	time spent on each form tabulated by computer
Mail clerks	letters or packages per unit time	collected by letter of package sorting machines
Bank proof clerks	checks processed per unit of time	collected by proof machine

SOURCE Off Ice of Technology Assessment 1987

agement sets standards of production and then makes records of actual performance in order to compare them to the standard. For many kinds of work, manual recordkeeping systems or physical counts of completed work are used to gather performance information, but the growing availability of computer-based systems in offices has led many employers to collect this information electronically.

Table 2 identifies some of the work conditions most favorable to the application of work measurement. The first set of conditions is that the work be routine and require the repetitive performance of a small range of tasks. When this is the case it is possible to time those tasks and establish a standard amount of time in which a competent worker can be expected to perform them (more about work measurement standard setting below). Measurement is also easier and more meaningful when there is a large volume of work from which to draw, or a relatively continuous flow of work.

Table 2.—Conditions Most Favorable to Electronic Work Measurement

Routinized work:
- small number of tasks performed by each employee
- large volume of work
- relatively continuous supply of work

Interchangeable workers:
- relatively low training requirement
- relatively small difference in the productivity of experienced and inexperienced workers, or short time needed to bring inexperienced workers to full capability
- tolerance for turnover
- ample labor supply

Simple data collection:
- employees use information technology as part of their work
- information about transactions is already being collected for other purposes
- data collection is transparent to the users, and making use of it is simple for supervisors

SOURCES Adapted from Robert E Nolan, "Work Measurement," in Robert N Leherer, *White Collar Productivity (New* York, NY McGraw Hill, 1983), also personal communication from James Rule, August 1986

Routine tasks can be performed by interchangeable workers. Individual employees may come and go (turnover) but the work still gets done. These jobs do not require a worker to have rare personal qualities, extensive professional training, or highly specialized skills. The training required for most routine jobs is minimal, and the amount of time needed for a newly trained worker to reach full competence is usually short, Training for some types of data-entry jobs, or for such jobs as proof machine operators in banks, can be accomplished in as little as a few days. Other routine jobs, however, require more skills and longer training. For example, training for telephone customer service representatives at firms interviewed by OTA ranged from a few days to 6 weeks, depending on the firm and the complexity of the services offered.

Although work measurement is most easily applied to less skilled jobs, it is increasingly being directed to higher level, more skilled technical, professional, and managerial positions. Even the most complex work has its routine elements, and given sufficient analysis, those elements can be identified, grouped together, and counted. The jobs of commodities broker, computer programmer, and bank loan officer, for example, could lend themselves to monitoring. They all have a high proportion of routine elements. But these jobs also require

higher levels of training and experience. Work measurement and electronic monitoring can be used in jobs like these, but if workers resent them, the costs of resistance might be unacceptably high for the employer. A firm's perception of the interchangeability of certain types of workers, the ampleness of replacement labor, or their own tolerance for turnover are all relative. They can change over time with variations in corporate goals, job markets, managers' personalities, or internal corporate politics.

As was pointed out in OTA's earlier report on office automation, the change in work process that takes place when certain types of professional or technical workers start making use of computers, sometimes leads to greater standardization or routinization of their work.[4] Some researchers hold that the increased use of computers to assist professional and managerial work will lead inevitably to the de-skilling of mental work and the creation of "intellectual assembly lines."[5] Many employers are greatly concerned with getting higher performance from highly paid professional and managerial workers—the "last great frontier" of productivity improvement. Computer monitoring can offer a way to make them more accountable and to measure their performance against performance goals. There will be further discussion on electronic monitoring of professional, managerial, and technical workers later.

In table 2 the final group of characteristics typical of monitored jobs is "simple data collection." As noted below, performance statistics can be collected about many routine office jobs that are *not* computerized, usually by having the employee or supervisor keep paper records. Care must be taken to design a means of data collection which does not unduly burden workers or supervisors–otherwise the measurement system may decrease productivity because it takes too much time or reduces morale. Further, a work-measurement system that requires people to take an extra step to keep performance records maybe subject to error or fraud. With electronic monitoring, manual recordkeeping can often be reduced or eliminated, even while much more detailed measurements are being made.

Jobs involving telephone contact with the public are often subject to "service observation," that is, having a supervisor or quality control specialist listen in on employee telephone calls to evaluate courtesy, accuracy, or compliance with company guidelines. Service observation is a common practice in telemarketing firms, direct sales outlets, market research firms, companies with large customer service departments, and of course telephone companies. Service observation is not new; telephone companies have been practicing it for over 80 years, as have many other firms. Service observation is also not automatic. It requires a human listener to make judgments on the content of a call.

However, new information technology has been transforming service observation by developing systems that integrate service observation with other, more automatic, monitoring techniques and also by improving the quality of new equipment. In older telephone systems, for example, a drop in volume or a click might be heard when an observer came on the line. Most modern service-observation equipment is perfectly silent and does not interfere with the operation of lines.

[4] U.S. Congress, Office of Technology Assessment, *Automation of America Offices,* OTA-CIT-287 (Washington, DC: U.S. Government Printing Office, December 1985), p. 105.

[5] Judith A. Perrolle, "Intellectual Assembly Lines: The Rationalization of Managerial, Professional, and Technical Work," paper presented to the American Sociological Association, Washington, DC, August 1985.

HOW WIDESPREAD IS ELECTRONIC WORK MONITORING?

Work Monitoring in the Private Sector

It should be noted that many computers record information about individual workers' computer use as part of computer security programs, audit trails, or cost allocation programs. Thus, in nearly every organization that has a mainframe, minicomputer, or integrated word proc-

essing system, computer-generated records are made when a terminal logs on or off; when a database is accessed; when a file is created, revised, or deleted; or when a remote computer is accessed through telecommunication lines. Some privacy implications of computer security systems will be addressed separately in a companion report. [6] However, for the purposes of the present report, such records are not considered to be work monitoring.

There are no reliable figures on how extensively employers are applying computer-based software to monitor individual employee performance, or to what extent they are using it to make judgments on individual pay, promotion, or discipline. No one has such figures, and no available basis for calculating them is at hand.

Before trying to estimate how many office workers are subject to work monitoring by computer, it is important to clearly define work monitoring. In this report, work monitoring will refer to the computerized collection of transactions on performance statistics used in individual work evaluations. Based on this definition it appears, as will be discussed in this section, that only a minority of office workers are monitored.

According to one work-measurement expert in the health insurance industry, some sort of statistics are collected about the computer transactions of nearly everyone who uses a computer—about 80 percent of the people in the industry. However, he estimated that only for about 20 percent of the people were these statistics actually used to measure individual performance.[7] This 20 percent represented primarily the low-skill end of the clerical work force.

Some information on monitoring was collected in the 1984 National Survey on Women and Stress, conducted by 9 to 5 National Association of Working Women. This survey received responses from 40,000 readers of four major women's magazines— *Working Woman, Ms., Glamour,* and *Essence.* Of the 4,500 responses randomly selected for analysis, 43 percent reported that they used visual-display terminals (VDTs), cathode-ray tubes (CRTs), or personal computers (PCs). Of these users, 25 percent were in managerial jobs, 30 percent were professional and technical workers, and 44 percent were in clerical jobs. The clerical category combined secretarial, customer service, data entry, and similar job titles.

One question on the survey asked:

> Is your work measured, monitored, "constantly watched" or controlled by machine or computer system.

Seventeen percent of all office automation users answered "yes" to this question. When broken down by occupation, 20 percent of clericals answered "yes," compared with 15 percent of managers and professionals and and 13 percent of technical workers.

Some critics have noted that the sample in this survey is self-selected, and that the results may not be representative of all women in the U.S. work force. On the other hand, the positive replies to the question on monitoring may be lower than the actual incidence of electronic monitoring in the United States. In the course of doing this study, OTA staff and contractors often found it difficult to ask about work monitoring with a simple yes or no question. Some people simply did not understand the question without further explanation. Workers in some locations did not know that they were being monitored. In other firms, computer use information was collected but not used for but individual evaluation.

One small survey of office automation use at 45 large New York firms, conducted for OTA, suggests that electronic monitoring is still not widespread at those firms. Only eight firms (18 percent) reported using information collected through electronic monitoring as a basis for individual performance evaluations, and six firms (13 percent) used it for team or work group appraisal. Fourteen firms (31 per-

[6] See Office of Technology Assessment, "Federal Policy on Electronic Information Security: Emerging Issues and Technological Trends, " forthcoming, 1987.

[7] Fred Friedman, Director of Operations Strategy, Blue Cross Association, interview, May 23, 1986.

cent) used automatically collected data for planning work force requirements.[8]

On the other hand, another survey of 110 organizations in 1982-84 found that the great majority of firms (80 to 90 percent) collected individual performance statistics for at least some of their workers.[9] Most of the jobs affected were the clerical jobs, but some were professional or technical. About one-quarter of the firms collecting performance statistics said they did so only for assessing group performance, to plan for peaks and valleys of work demand, and to cost-justify their use of the office systems. The remaining three-quarters were using individual operator statistics to make some sort of individual evaluation—whether for base pay, incentive pay, promotion, or training-for some of their work force. In some cases, machine statistics were "almost the entire basis" for such judgements, and in others it was "one factor in five or six factors used to evaluate performance. "

A survey of the same 110 organizations in 1985-86 revealed no increase in the percentage of employers using computer measurement for personal evaluation. However, a majority of the firms now reported that they had created a' 'more formal system' for setting work standards and letting employees see the results of monitoring if they wished.[10]

Those organizations not collecting statistics at all were usually either:

1. organizations using older word processors or microcomputers that did not have software for measurement;
2. organizations with new applications in early implementation;
3. non-profit organizations or universities who "just don't do that"; or
4. State and local government agencies which "saw no need to compile those records. "

Service observation, which is usually done for jobs where employees have a great deal of telephone contact with customers, is often combined with electronic measurements of productivity as well. As mentioned above, service observation is a standard practice in the telephone industry, and most of the Nation's 226,000 operators and service representatives are evaluated in this way. In addition, the great growth of telemarketing and telephone customer service in the past decade means that an increasing number of employees are affected by service observation. A few firms interviewed by OTA reported that they had service-observing capabilities in their telephone systems but did not use them.

Westin estimates that the great majority of clerical employees working on computer terminals-in the 65 to 80 percent range-are not currently being monitored by computer and evaluated for pay, promotion, or discipline on that basis.[11] Further, most professional, technical, and managerial workers—95 percent or more—are not currently evaluated based on computer statistics. However, if 20 to 35 percent of clerical employees are being monitored, this means that 4 to 6 million employees are being evaluated in this manner. The addition of professional, technical, and managerial workers could add another million or two to the total, and this number could grow steadily larger over the next 5 to 10 years. To this total also should be added retail sales workers and grocery clerks, whose speed and sales volume are sometimes monitored via electronic cash registers.

The clerical work force is predominantly female, and the low-skill end of the clerical work force has a disproportionate number of minority women.[12] Similarly, women are more likely to be employed in the lower levels of professional work, such as routine computer programming or routine insurance underwriting, rather than in higher levels of those professions. Because monitoring is most likely to be

[8] Hay Group, Inc., "Analyses of Customized Items for the Office of Technology Assessment, " 1986 Hay Office Systems Survey, September 1986.

[9] Alan Westin, "Privacy and Quality of Work Life Issues in Employee' 'Motoring," contractor report prepared for OTA, 1986.

[10] Ibid.

[11] Ibid.

[12] U. S. Congress, Office of Technology Assessment, *Automation of America Offices, OTA-C IT-287* (Washington, DC: U.S. Government Printing Office, December 1985), pp. 300-304.

applied to precisely these lower level jobs, work monitoring is a topic that especially affects women and minorities.

Work Monitoring in the Federal Government [13]

The work-monitoring practices in the Federal Government tend to follow some of the same patterns as the private sector. There are no reliable statistics on how many Federal employees have their work monitored by computer.

In general, Westin's survey, combined with interviews by OTA, found the same sort of distribution in the use of work monitoring in the government as in the private sector. Some agencies, or specific work groups within agencies, used performance statistics only at the aggregate level and only for planning or budgeting purposes. Some used monitoring statistics as part of individual evaluation of some workers, usually clerical workers. Some, especially small agencies and those with older equipment, did no monitoring at all.

The following are a few specific examples of applications of work monitoring in the Federal Government. For example, performance statistics are automatically collected for data transcribers at the Department of Agriculture's National Finance Center. Statistics include a total time on machine, keystrokes per hour, and errors. Supervisors get daily, weekly, and monthly reports; operators get feedback monthly and some also maintain manual records of their own performance. [14] Similar performance criteria are used for data transcribers at the Bureau of the Census, but because of the design of the computer system, keyers must record the time manually. When a new system is installed in 1988, all information will be collected automatically. "

The Department of Labor's Office of Workers Compensation monitors the work of claims examiners and bill examiners. For claims examiners the statistics include time elapsed from case creation to case adjudication, number of adjudications, number of wage loss claims processed, and elapsed time from receipt of claim to decision. Bill examiners statistics include number of bills paid per day, time elapsed from receipt of bill to payment. Claims examiners are in the GS 5- I 1 range; bill examiners are typically GS 4-6. [16]

The Internal Revenue Service, which has recently implemented its Automated Collection Service, employs about 2,300 contact representatives who speak with delinquent taxpayers by telephone, negotiate payment schedules, and update taxpayer files. Performance data is collected by computer (time per transaction, time logged on and available for work); in addition supervisors are required to listen in on calls to monitor for courtesy and correctness of information. Employees know that service observation is performed, but do not know specifically when they are being listened to. According to IRS sources, service observation is fairly infrequent and used primarily for training of new employees.

At the Social Security Administration's Teleservice Centers, service observation capability of the new telephone system has become a matter of dispute between SSA and the union representing 1,500 teleservice workers (American Federation of Government Employees). The union is attempting to negotiate specific time periods during which service observation will be used. At present it can be applied at anytime and employees do not know whether they are being monitored.

Given similar levels of computerization in the Federal Government and the private sector,[17] it seems likely that the number of monitored office workers in the Federal work force is similar to the private sector—20 to 35 percent.

[13] This section is based on a survey performed by Westin in 1984 of 44 Federal agencies. See Alan Westin, "Privacy and Quality of Work Life Issues in Employee Monitoring, " contractor report prepared for OTA, 1986, pp. 39-63. In addition, OTA staff interviewed a number of Federal agency managers and union officials.

[14] Based on OTA interviews.

[15] Based on OTA interviews.

[16] Based on OTA interviews.

[17] See OTA, *Automation of America Offices,* op. cit.

HOW TECHNOLOGY ASSISTS SELECTED BUSINESS APPLICATIONS

The technology used in computerized work measurement is not especially esoteric. Most people whose work is electronically measured are working on mainframe or minicomputers or are using telephone systems controlled by minicomputers. Stand-alone personal computers generally do not have the power to maintain sophisticated work-measurement software while also carrying out the desired application. [See later section on "Personal Computer Monitoring. Office systems that interlink a number of computers may sometimes have one computer dedicated to monitoring and measuring workflow.

Some work-monitoring software systems are available commercially, but in many cases, firms with large data processing departments develop their own work-monitoring software in-house, or with the help of work-measurement consulting firms. Commercially available systems in common use include those associated with key-to-disk data-entry systems, automatic call distributors, and "back office computers" for travel agents, which will be discussed later.

Individual work-measurement statistics can be developed using information that is already being collected for some other purpose. Developing work-measurement statistics from this information is simply a matter of being able to retrieve some or all of this information, store it in a separate file, and perform statistical analyses.

Because it is based on analysis of readily available information, work monitoring can even begin "accidentally," without a specific management plan to introduce it. For example, in one Midwestern bank, the data processing department installed a "black box" to record the time, type, duration, originating terminal, and user for every inquiry or transaction in on-line databases. The purpose was to monitor the speed of computer response time and to make sure other departments were getting the level of service promised by the data processing department. Itemized reports were sent to managers, who found that these reports were useful for other purposes, such as planning personnel schedules, justifying requests for new staff or equipment, and measuring the time it took individual employees to complete transactions.[18] They are now being used as work-monitoring tools in at least some of the participating departments.

In most locations, work-measurement tools were developed explicitly for the purpose, but the idea is still the same. They collect and reanalyze information that is already being recorded about computer utilization or business transactions. For example, travel agents at some large agencies work on terminals connected to a network that includes a nearby minicomputer and a mainframe computer at some central location. The applications software in the mainframe allows them to check schedules and make or cancel reservations. The minicomputer, called in some organizations the "back office computer, " records details about computer utilization. It notes who logged on to which terminal at which time, and it also makes records of the time, type, and amount of each transaction that the agents perform on the mainframe. Thus the back office computer provides a local audit trail and sales record for the whole office. This information can be used in a number of ways, for example, it allows the local printing of tickets and itineraries for customers. It also can be used to develop individual performance histories, since it has a complete record of all the computer activities of each agent.[19]

In other firms interviewed by OTA, work monitoring software was an integral part of the application software. That is, the same computer software package that helps an insurance claims examiner to key in client information and calculate the amount of a payment,

[18]OTA interview with Senior Vice President for Operations, a rnidwestern bank, May 1986.
[19]OTA interview with three travel agency managers, June 1986.

also automatically tallies the number of claims of each type that each examiner completes in a day. In several cases these tallies were then transferred to another computer program, perhaps in a personal computer, which does statistical analyses, compares performance to established standards, and prints reports for supervisors.

Collection of data about employee performance can in many cases be made transparent to the user, that is, information can be collected without interfering with the work that is being done. From the viewpoint of the user, an automatic call distributor (ACD) simply routes incoming calls to individual telephones. In actual fact, however, the distributor is also automatically recording the type of call (inside or outside line), the time the call arrived, the identity of the employee to whom it was routed, the number of seconds before the employee picked up, the time the call started, the time the call ended, the number of times the caller was put on hold and for how long, the extension to which the call is transferred, the number of seconds before that person picked up, and so on. In addition, it can show the supervisor at any moment which operators are busy, which are waiting for work, which are on break. At the end of the day it can provide summaries of individual and group activities.

Properly organized, this can be very useful management information. For example, an ACD can report the number of seconds customers were "delayed" before someone was available to help them or the number of customers that "abandoned" calls-hung up without speaking to anyone. If these figures get too high it may indicate the need for more telephone lines and more customer agents. Analysis of daily or monthly work volumes can help managers better understand cycles in their business so they can predict busy periods when they must hire temporary workers or offer overtime.

The example in figure 2 shows such a status report. Service level ("serv level' is the percentage of incoming calls that were answered within the specified time (typically 20 seconds). Calls offered is the total number of calls, including those that were lost, delayed, or diverted as shown in the following columns. Positions manned ("pos manned") means the number of agents jacked in and ready to work; the following columns indicate whether the agents are on incoming or outgoing calls. Average delay is the average time in seconds for a call to be processed, whether answered, delayed, or lost. The next columns show the number of calls waiting (CW), the maximum number of calls that were waiting at any time in this period, and the number of seconds that the current longest call waiting has waited.

Here again, reports about individual performance are fairly simple to develop based on information that must be collected in any case. In order to route calls, the computer controlling an automatic call distributor must keep track of which telephones are busy, which are available, and which are unattended at any given time. However, this information must be sorted and averaged in order to be of use. A supervisor could make no sense of all the detailed information that a computer collects about each call. The work-monitoring software sorts, totals, averages, and summarizes the information so that a supervisor can see activities of the entire work group, or totals and averages of each individual's activities for a given

Figure 2.— Example of a System Status Report for an Automatic Call Distribution System

Gate	Serv level	Calls offrd.	Calls dlyd.	Calls Lost	Calls div.	Pos. manned	Calls in	Calls out	Avg. delay	CW	Max CW	Odly time
1	47	"	15	8	7	1	6	0	2	1	0	1	0
2		43	7	4	4	0	3	1	2	2	3	3	91
4		67	6	2	1	1	6	0	0	7	0	1	0
		52	28-	14	12	2	15	1	4	'3	3		

SOURCE: Adapted from Solid State Systems Inc., "The Smart Telephone System ACD Supervisor User's Guide," Marietta, Georgia, 1982

timed period, or exception reports, that show particular calls or particular employees that are far out of the average range.

Figure 3 shows the type of information typically available on the VDT screen of the supervisor of a group of telephone customer service workers using an automatic call distribution system. Status options here include vacant ("vent") or on break, talking ("talk") or available for calls ("avlb")." Work" means the agent is doing other work related to a previous call, perhaps updating the database or preparing a letter to the customer, and is not accepting calls. The agent named Joe is talking and has signaled for 'help, " requesting the supervisor to come on the line. The time column shows how long (in minutes) the individual has been in the current status. The last column shows that three agents have calls waiting for them on other lines.

The example in figure 4 shows the sort of information that might be included in productivity reports summarizing periods of a few hours, or a day, or a week. This example reports the number of calls, the total handle time ("hndl") in minutes (the sum of "talk time" and "work time' '), and the total time available and waiting for calls, in minutes. In addition the report shows the average handle time, talk time, and work time per call in seconds.

Figure 3.—Example of a Supervisor's Display in an Automatic Call Distribution System

SUPERVISOR	GATE	AGENT NO	AGENT NAME	STATUS	TIM E	10:32 SUPVS 1	5/10/87
1	1	513	SAM	VCNT	6.3	CW 4	
	1	512	JANE	TALK	0.3		
	1	514	JOE	HELP	1,2		
	1	560	BILL	WORK	4,7		
	2	570	FRED	AVLB	6.3		
	2	510	SUE	TALK	1,2		
	2	513	SAM	VCNT	6.3		
	3	512	JAN E	TALK	0.3	CW 1	

SOURCE Adapted from Solid State Systems Inc The Smart Telephone System ACD Supervisor User s Guide Marietta Georgia 1982

Figure 4. —Example of Agent Statistics From an Automatic Call Distribution System

14:32 10/14/82 AGENT STATISTICS

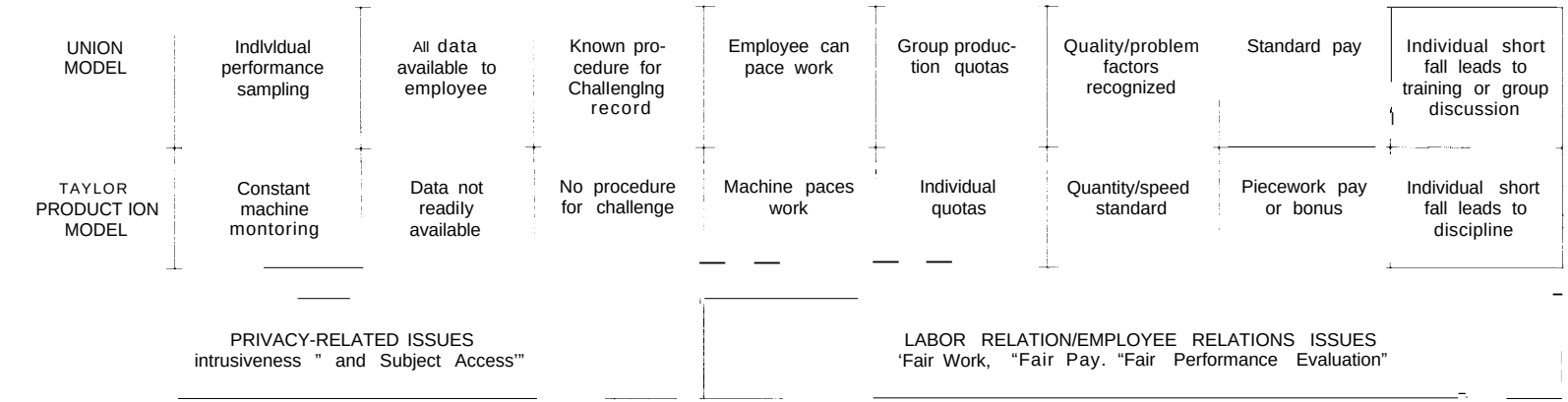
AGENT GROUP 4		GATE	NO. CALLS	HNDL TIME	TALK TIME	WORK TIME	AVLB TIME	AVG HNDL	AVG TALK	WORK
GEORGE	454	1	0	0,0	0.0	0.0	0.0			
HARRY	455	1	0	0.0	0.0	0.0	0.0			
JERRY	582	1	6	8.4	8.4	0.0	6.9	84	84	0
SUPV1	580	1	5	3.5	3.5	0.0	5.7	53	53	0
SUSANNAH	501	1	5	10.0	10,0	0.0	5.3	120	120	0
BILL	503	1	4	3.6	3.6	0,0	3.2	54	54	0

SOURCE Adapted from Solid State Systems Inc 'The Smart Telephone System ACD Supervisor User's Guide, ' Marietta Georgia 1982

WORKPLACE ISSUES RELATED TO WORK MONITORING

People in some organizations perceive work measurement and service observation to be useful tools that help employees and management at all levels to put out a good product. At other organizations, use of the same technologies is resented and feared as "Big Brother

Figure 5.– Two Models for Electronic Work Monitoring



SOURCE Alan F West in Privacy and Quality of Life Issuesn Employee Monitoring contractor report for OTA 1986

Table 3.—Workplace Issues Related to Work Monitoring

	Privacy and access related	Labor relations or "fairness"	Health/quality of life
Is monitoring constant or intermittent?	X		X
Can employees see their own records?	X		
Can the employee challenge, explain, or correct records?	X	X	
Does the employee or the machine pace the work?		X	X
Do employees understand performance criteria and use of information?		X	X
Are quotas set on an individual or group basis?		X	
Are quotas fair, allowing work at a reasonable pace?		X	X
Is pay standard or based on performance?		X	
What happens to employees falling short of quota?		X	X

SOURCE Off Ice of Technology Assessment, 1987

surveillance. " The difference seems not to be so much in the specific measurement technology, but in the politics of how it is introduced, how it is used, and what is done with the information collected.

Although many workers' complaints about monitoring focus on its intrusiveness, a closer look shows that privacy is only one of a complex of issues raised by electronic work monitoring. Table 3 outlines some possible characteristics of a work-monitoring program and indicates the kinds of issues that are raised by them. Privacy and access issues cover such questions as whether employees know they are being monitored and whether the employees have access to records about their own performance. The second set of issues relates to the perceived fairness of the monitoring system and the way the employer uses it in evaluating and rewarding employees; these are questions of employee relations. The final set of issues, overlapping the other two, relate to stress, health, and the quality of working life.

Whether the effect of monitoring is perceived as intrusive, unfair, dehumanizing, or unhealthy often depends on how management structures the work-monitoring program, what it does with the data it collects, and how those actions are perceived by employees.

What Is Fair

Westin used some of the same elements discussed in table 3 to construct two models of work monitoring shown in figure 5.[20] Westin chose to call the first model the "union' model, since it represents a blend of features included in model contract language suggested by some U.S. and international unions. The second he called the "Taylor production" model; it is based on an extreme form of an industrial engineering approach to work measurement, one which places virtually all information and power in the hands of management. In applying these models to the organizations interviewed for OTA, no pure examples of the "union model" were observed. The "Taylor production model" in its pure form was observed in action in a few government and private sector organizations. Most organizations used methods representing a blend of the features of the two models, with about two-thirds of the organizations interviewed by Westin tending toward a modified version of the "Taylor" model.

In most cases, employers introduce electronic monitoring unilaterally, only informing employees of the change after all decisions have been made. Often, too, monitoring is only one of a number of changes in work process or job design that take place when new office equipment is purchased. As was discussed in detail in OTA's report, *Automation of America Offices,* employee participation in design and implementation is often a key to successful implementation of new office systems.

Ensuring employee participation can require effort on the part of managers, as few U.S. workplaces have mechanisms for employee input in areas of technological change or evaluation procedures. Nevertheless, Westin found that the difference between employees protesting over "Big Brother surveillance" and employees perceiving work measurement as rea-

[20]This section draws heavily on Alan Westin, "Privacy and Quality of Work Life Issues in Employee Monitoring, contractor report prepared for OTA, pp. 103-112 (draft).

sonable, often depends on whether they agree on: 1) the fairness of the standards set; 2) the fairness of the monitoring process employed; and 3) the fairness of the way measurements are used in employee evaluation. This agreement was usually made through worker-management discussions before monitoring was implemented. Such agreements are possible where there is genuine involvement of employees—either through joint labor-management committees in unionized organizations, or through employee involvement techniques in nonunion settings. Where management started with the trusting assumption that almost all employees were ready to put in a fair day's work for a fair day's pay, and where topics such as work standards, work measurement, and productivity recognition were matters for open discussion, introduction of monitoring was usually relatively painless.

One impression that emerged from OTA's interviews is that the way managers and employees deal with monitoring often closely parallels the way they deal with other workplace issues. Firms whose "corporate culture" tends toward authoritarianism tend to use monitoring in an authoritarian way. In organizations where relations between employees and managers are antagonistic, the monitoring system is a source of antagonism, but only one of many. In organizations where cooperation is the norm, people worked together to de velop a fair system.

Recognizing that employee involvement in the design, testing, implementation, and continuing adjustment of work monitoring is crucial to a successful process, it is also necessary to deal with the *substantive issues,* to be considered in designing such a program. Table 4 shows some of the issues to be considered. The main categories, and the specific questions in this chart represent recurring themes in a number of interviews with monitored workers and their managers.

Westin's sample found that only about one-third of the firms in his sample using electronic work monitoring for individual evaluations were following what he called 'fair work evaluation policies' along the lines of a positive answer to most of the questions in table 4.

Table 4.—Key Issues and Problem Areas in Monitoring Worker Performance

Key issues/problem aspects
Fairness of work standards:
• Do standards fairly reflect the average capacities of the particular work force?
. Will they create unhealthy stress for many employees?
• Do they take into account recurring system difficulties and other workplace problems?
. Do they include quality as well as quantity goals?
• Do they represent a "fair day's pay'" for a' fair day's work?'
. Do employees share in any productivity gains achieved through introduction of new technology?
Fairness of the measurement process:
• Do employees know and understand how the measurements are being done?
• Can the measurement system be defeated easily, thereby impairing the morale of those willing to "follow the ru!es?"
• Do employees receive the statistics on their performance directly, and in time to help them manage their work rate?
• Is the relation between quality, service measures, and work quantity communicated by supervisors when they discuss problems of performance levels with employees?
• Do supervisors communicate clearly that they are taking system and workplace problems into account?
• Are group rather than individual rates used when particular tasks make such an approach more equitable?
• Is there a formal complaint process by which an operator can contest the way work data has been used by the supervisor?
***Fairness in applying measurements to** employee evaluation:*
• Are there meaningful recognition programs for these employees?
. Is work quantity only one of a well-rounded and objective set of performance criteria used for employee appraisals?
Ž Does the employee get to see and participate i n the performance appraisal?
. Is there an appeal process from the supervisor's performance appraisal?
• Is there a performance-planning system that identifies employee weaknesses in performance and identifies ways to remedy such problems?

SOURCE Alan R West In, "Privacy and Quality of Life Issues in Employee Monitoring, " contractor report for OTA, 1986

Of the 34 case examples submitted to OTA by unions, 28 dealt with electronic monitoring of office workers (unionized and nonunionized) like the ones studied by Westin. In nearly all the case examples, employees had little input concerning the monitoring system, and in only a few cases was it clear that they had access to information about their own performance or the ability to contest wrong information. In nearly all these cases the workers were

described as considering the monitoring system unfair.[21]

Standards of Performance

Work measurement systems are usually applied to jobs for which standard end products, or surrogates for end products, can be clearly identified. That end product might be "customers served, " "claims paid, " "programs written, " "interviews completed. " Generally speaking, electronic work monitoring primarily measures the quantity of work performed. Other methods, discussed in the next section, measure quality.

An important element in measurement of almost all kinds of work is *time*. In almost every case in table 2, the purpose of measurement is to measure the time it takes the employee to do something, and then to compare the result to a standard. Robert Nolan, an expert in developing work-measurement systems, defines a work-measurement system in this way:

> In the most simple terms, it is a means of establishing what a fair day's work should be. It has two main components, a measure of the volume of work, and a measure of the employee time used up. These two factors can be expressed in their only common denominator: the time required to produce one unit of work, or what we call a standard.[22]

Thus, measurement alone is often of little use as a management tool, unless its purpose is to compare the individual or group performance to a standard.

Standards may be established in a number of ways. Many are arrived at rather informally or arbitrarily, perhaps based on supervisors' or managers' estimates of how long it ought to take to complete certain tasks. In some cases standards are set based on historical performance levels; managers may take an average of some past period, and expect that it be maintained as an average in the future.

Sometimes "standards" are really goals or ideals. In one firm interviewed by OTA the standard of 50 completed transactions per agent per week had recently been established by the national office. The standard was developed by dividing the average revenue per transaction into the total revenue the firm hoped to generate at each branch office.[23] The new standard was not related to past performance levels or analysis of the best way to do the job, but rather to the amount that must be sold in order to meet revenue projections. In this case, 50 transactions per week was far above past performance; office managers hoped that introducing incentive programs would inspire agents to achieve the new goals.

A more formal method of standard setting is the "engineered standard. " The Methods-Time Measurement (MTM) system or the Advanced Office Controls (AOC) system have been used in many office settings. In these methods, a trained analyst, usually an industrial engineer, observes a work task, selects the most efficient method of performing the task, and then will time the actions of average people performing the task under average working conditions. General MTM and AOC standards have been developed for nearly every imaginable motion in an office workplace. For example, the MTM standard for fastening sheets of paper with a table model stapler is 41 time measurement units (TMU), or about 2.9 seconds. Opening an envelope and removing the contents takes 198 TMU or 14.2 seconds. A trained analyst can combine a number of these general standards, develop new ones, and adapt them to the special circumstances of spacial arrangement, work process, or equipment use in a given office.[24]

A well-designed standard, according to experts, is not one that makes people work as fast as possible, but one that encourages good average work. It should include time for personal breaks and allow for personal variabil-

[*]"AFL-CIO Case Examples, " November 1987.

[22]Robert E. Nolan, "Work Measurement, " in Robert N. Leherer, *White Collar Productivity* (New York, NY: McGraw Hill, 1983), p. 111.

[23]OTA interviews, assistant manager, Washington office, national travel firm. June 1986.

[24]Examples from Robert E. Nolan, "Work Measurement, in Robert N. Leherer, *White Collar Productivity (New* York, NY: McGraw Hill, 1983), pp. 142-146.

ity — working a little faster at some times and slower at others. Fair standards must be realistic, taking into account system downtime, slow response time, varying levels of complexity of different tasks, and so on. When standards are not realistic, or when they are not perceived as fair by employees and managers, they can easily lead to declines in morale, increased turnover rate, and ultimately a decrease in productivity.

Since AOC, MTM, and other "predetermined time' systems provide a standard time for the completion of each task, an employee's actual performance can be compared to that standard. If the standard time for examining a certain type of insurance claim is 10 minutes, then an employee who completes 6 of them will have done 60 standard minutes or 1 standard hour's worth of work. An employee who completed 48 such cases in an 8-hour day would be said to be working at 100 percent of the standard, that is, his or her *paid* hours would exactly equal standard hours. Faster employees might work at 110 or 120 percent of standard, while slower ones work at 80 or 90 percent of standard. The determination of an "acceptable' pace depends on the firm, but a well-designed standard is one where most trained, experienced employees will work in the range of 85 to 100 percent of standard most of the time. [25]

Figure 6 shows part of a weekly work monitoring report for an insurance employee working under a' 'predetermined time' work-measurement system. The report lists the types of tasks done, the standard time to do the task once, the number of times the employee actually completed the tasks, and a calculation of the "earned' hours. Figure 7 summarizes work of a group of insurance employees. Figure 8 integrates the work monitoring system with a time and attendance report. It shows the number of hours each employee was available for work ("avail work"). The time available for *measured* work ("avail meas' '—employees may have other duties that are not captured by the system) and the number of earned hours ("earn hrs") worth of work completed. Note that there

[25]See Robert E. Nolan, "Work Measurement, ' in Robert N. Leherer, *White Collar Productivity (New* York, NY: McGraw Hill, 1983), p. 121.

Figure 6. —Example of Individual Work Monitoring Report (Performance Summary)

RUN NUMBER ARM1B140 — WORK MANAGEMENT PROGRAM
DATE OF RUN - 10/09/84 — INDIVIDUAL PERFORMANCE REPORT
TIME OF RUN -18:00

WEEK ENDING 10/6/84

EMPLOYEE — EMPLOYEE D
DIVISION : G — CLAIMS AND SERVICE
DEPARTMENT: GB CLMS PROC

CALCULATION OF EARNED HOURS

DV	DP	KVI DESCRIPTION CODE	NAME	UKVI FLAG	AVERAGE TIME TO DO ONE ITEM	x	ITEMS COMPLETED	–	EARN ED HOURS
G	GB	0040	EOB STUFF		00 MIN 16 SEC		148		0 6
G	GB	0050	SUBSCRIBER PREP		01 MIN 48 SEC		2		0,0
G	GB	0070	SUBSCRIBER CODING		03 MIN 54 SEC		2		0.1
G	GB	0080	PROVIDER CODING		01 MIN 03 SEC		8		0.1
G	GB	0140	MEP ADJUDICATION		02 MIN 47 SEC		482		22.4
G	GB	0150	VISION ADJUDICATION		02 MIN 33 SEC		68		2.9
G	GB	0175	PRIMARY GSCR ROSTER		00 MIN 10 SEC		621		1.8
G	GB	0176	GSCR CHK-ADJUDICATOR		00 MIN 08 SEC		454		1,0
G	GB	0190	COB PROCESSING		04 MIN 57 SEC		20		1,6
G	GB	0210	COB RETURN LETTERS		00 MIN 49 SEC		50		0.6
G	GB	0185	PULLING CLAIMS		03 MIN 00 SEC		8		0.4
					TOTAL EARNED				32.0

SOURCE Adapted from James S Hogg Manager Professional Productivity Blue Cross & Blue Shield of Maryland

Figure 7.—Example of a Work Monitoring Report for a Group '(Volume of Work Accomplished by Group in One Week) "

RUN NUMBER - ARM1B130 WORK MANAGEMENT PROGRAM
DATE OF RUN 10/09/84 VOLUME SUMMARY FOR WEEK ENDING 10/06/84
TIME OF RUN - 18:13

DIVISION: G CLAIMS AND SERVICE
DEPARTMENT GB CLMS PROC
UNIT xxx
SECTION YYY

KVI CODE	KVI DESCRIPTION	VOLUME	PERFORMANCE REFERENCE	EARN ED HOURS
0010	MAIL SORT	1938	0,0068	132
0020	PROCESS IN COMPLETES	219	0.0085	19
0040	EOB STUFF	2105	00046	9.7
0050	SUBSCRIBER PREP	216	00280	60
0051	PROVIDER PREP	425	00045	19
0060	MEDICARE CLAIMS PROC	391	00385	151
0070	SUBSCRIBER CODING	457	0,0657	300
0080	PROVIDER CODING	1496	00179	268
0090	SUBSCBR DATA ENTRY	293	0,0224	6.6
0100	PROVIDER DATA ENTRY	1072	0.0185	198
0110	VISION PREP & CODE	164	00246	40
0120	VISION DATA ENTRY	168	00236	40
0130	PAF REPORT UPDATE	232	00100	23
0140	MEP ADJUDICATION	846	0.0466	394
0150	VISION ADJUDICATION	70	0,0426	30
0160	PHONE INQUIRY	382	01015	388
0175	PRIMARY GSCR ROSTER	1740	00030	52
0176	GSCR CHK-ADJUDICATOR	926	0,0023	21
0180	ADJUSTMENT CODING	15	0.0927	14
0181	PROC. CODED ADJUSTMTS	14	00454	06
0182	HND. PROC ADJ/NO FILE	14	00102	01
0183	ART COMP-HANDLG REFD	15	01284	19
0185	PULLING CLAIMS	8	0.0496	04
0190	COB PROCESSING	36	00823	30
0195	WRITTEN CORRESPONDENCE	21	0.3801	8.0
0200	PROC OCC DELETES	43	01054	45
0210	COB RETURN LETTERS	55	00135	07

SOURCE: Adapted from James S. Hogg, Manager, Professional Productivity, Blue Cross & Blue Shield of Maryland

is a wide variation in effectiveness ("eff %"), which calculates the earned hours as a percentage of measured hours. This particular firm does not use an incentive system so all employees are paid for their regular hours despite these differences. The report also shows totals for the whole group.

The work process-the set of procedures that govern what tasks are done and how tasks interrelate—also has a major impact on many predetermined-time work-measurement systems. Because the "standard" for each task or set of tasks depends on a close study of the work performed, any changes in the work require a change in the standard, if the standard is to be fair. Changes in the work might arise when a new product is introduced (say, in an insurance company, a new kind of policy), or when regulations change (e.g., requiring a change in the kind of information banks must supply to customers), or when the technology changes. Work-management specialists at firms using predetermined-time systems note that "maintenance" is a major need if work measurement is to be applied conscientiously. Work must be periodically re-analyzed and standards must be adjusted.

Standard setting is often combined with job design, work simplification, or procedural changes, because it is difficult to establish a

Figure 8.—Example of Individual Work Monitoring Report (Hours Summary)

WORK MANAGEMENT PROGRAM
HOURS REPORT

RUN NUMBER - ARM1B140
DATE OF RUN - 10/09/84
TIME OF RUN - 18:08

WEEK ENDING 10/06/84

DIVISION: G CLAIMS AND SERVIC≤
D≤PARTMENT: GB CLMS PROC

EMPLOYEE			TIME SPENT AT WORK				TIME NOT MEASURED						
NUM	NAME	ST	REG. TIME	OVER TIME	TIME NOT WORKED	AVAIL WORK	PROD	RFW	UKVI	OTH	AVAIL MEAS	EARN HRS.	EFF %
1518	EMPLOYEE A	03	37.5	0.0	23.2	14.30	0.0	0.0	0.0	0.0	14.30	11.6	81
4529	EMPLOYEE B	03	37.5	0.0	0.2	37.30	0.0	0.0	0.0	4.9	32.40	26.4	81
4669	EMPLOYEE C	03	37.5	0.0	0.2	37.30	0.0	0.0	0.0	0.4	36.90	18.1	49
5206	EMPLOYEE D	03	37.5	0.0	0.2	37.30	0.0	0.0	0.0	1.9	35.40	32.0	90
5210	EMPLOYEE E	03	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.00	0.0	0
5244	EMPLOYEE F	03	37.5	0.0	0.2	37.30	0.0	0.0	0.0	1.0	36.30	15.1	41
5245	EMPLOYEE G	03	37.5	0.0	0.2	37.40	0.0	0.0	0.0	2.4	35.00	23.4	66
5246	EMPLOYEE H	03	37.5	0.0	0.2	37.30	0.0	0.0	0.0	5.7	31.60	22.0	69
5247	EMPLOYEE I	03	37.5	0.0	0.2	37.30	0.0	0.0	0.0	0.0	37.30	24.7	66
5255	EMPLOYEE J	03	37.5	0.0	0.2	37.30	0.0	0.0	0.0	7.7	19.60	29.1	148
5256	EMPLOYEE K	03	37.5	0.0	0.9	36.60	0.0	0.0	0.0	0.8	35.80	35.0	97
5257	EMPLOYEE L	01	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.00	0.0	0
5258	EMPLOYEE M	03	37.5	0.0	36.9	0.60	0.0	0.0	0.0	0.6	0.00	0.0	0
5435	EMPLOYEE N	03	37.5	0.0	15.2	22.30	0.0	0.0	0.0	1.8	20.50	12.9	62
SECTION TOTALS			450.0	0.0	77.7	372.30	0.0	0.0	0.0	37.2	335 °	250.3	74
COST CENTER TOTALS			450.0	0.0	77.7	372.30	0.0	0.0	0.0	37.2	335.10	250.3	74
PERSONNEL EMPLOYED		14											
EQUIVALENT PERSONNEL AVAILABLE FOR WORK					9.9								

SOURCE: Adapted from James S. Hogg, Manager, Professional Produc[illegible] Blu[illegible] Blue Sh[illegible]

set time for performing a task if everyone is free to do it in a different way. Some ways are better than others, whether faster, less fatiguing, or more reliable. Experts in productivity and work measurement usually counsel that employees should be included in the process of changing procedures and establishing standards. They argue that employee involvement not only short-circuits resentment to standards that are imposed from outside, but usually leads to the creation of better procedures and fairer standards, since employees understand the work that needs to be done better than anyone, including their managers.

An example of employee involvement in standards development is the case of legal case analysts at an insurance firm.[26] These highly skilled workers handle correspondence and track the progress of legal cases on a computer-based legal diary system (LDS). Although the LDS software created some internal statistics on the transactions done, they had not been previously used for individual evaluation because no standards had been developed for the case analyst's work. The work-measurement specialist assigned to develop standards found the work very complex and also saw that the legal diary software was very flexible, allowing analysts to use several different procedures for certain tasks. Instead of trying to prescribe procedures and standards, the work-measurement specialist held a series of 24 two-hour seminars in which the analysts talked about their work. They discussed different tasks, compared their approaches, and decided among themselves the simplest and most effective procedures for each task. They also helped to set the standard times for the tasks. Interestingly, the productivity of this department, in terms of dollars recovered through legal actions, began to increase before the final work measurement program was in place, presumably because the case analysts voluntarily began using the improved procedures as soon as they were developed in the seminars.

[26]James Hogg, "The Results of Technical and Professional Measurement in Insurance, " in Proceedings, 1986 AOC Users Conference, May 15-18, 1986, Robert E. Nolan Co.; also, personal communication, May 29, 1986.

Within many organizations, introduction of work measurement and the process of setting standards can become a hotly contested labor-management issue and a major source of employee discontent. Where employees are not involved in standard setting, they may view a new standard as an unfair "speed up, " an attempt by management to make them work harder for the same pay. Similarly, work simplification or procedural changes that are imposed from outside can be viewed as removing variety and autonomy from the job, and making it less interesting and more mechanical.

For example, the changes in work standards, evaluation, and pay that accompanied work monitoring for claims examiners prompted a unionization drive at Equitable Life Assurance. With the introduction of the measurement system, pay was changed from a straight salary to an incentive program that was based on performance. Examiners complained that they had to work much faster in order to make the equivalent of their old salaries. A few accepted transfers to lower paying jobs because they could not keep up the pace. The contract between Equitable and District 925 of The Service Employees International Union (SEIU), addresses some of the issues discussed in the section on "What Is Fair. " Under the contract, employees now have access to their own performance records and a procedure for challenging records. Evaluations are based 80 percent on computer-based statistics and 20 percent on supervisors' judgments. In addition, the contract changed several other working conditions, such as leave policy, that had been a subject of dispute.

When electronic monitoring allows a complete record of each worker's performance, it becomes easier to pay workers based on their output. Some call this a revival of the "piecerate' system and decry it as a form of worker exploitation. Often, however, performance does not translate into pay directly on a per-piece basis. For example, "incentive" plans pay a base rate for acceptable performance and bonuses for higher levels of performance.

Incentive programs appear to be fairly common in data entry, where there is a wide range of performance.[27] Operators who are very fast can increase their income by 50 percent or more above the base rate, depending on how the incentive plan is structured. In some firms where standards are based on a predetermined-time method (i.e., so many keystrokes equal one standard hour of work), slower keyers can make bonuses if they are willing to work for a longer time. This also raises fairness questions and worker protection questions, for example, should employees feel pressure to skip lunch or breaks in order to improve their performance?

Incentive programs have also been used by employers to increase the performance of a group of employees. In one bank, for example, industrial engineers studied the work of check-proof reading operators and found that the engineered standard was far above the current level of achievement of the department. Rather than insist that operators begin to work to the new standard, management began to pay regular wages to those who met the old average and bonuses to all whose work approached the new standard. As departmental proficiency increases, the management expects to raise the standard and adjust the bonus structure to encourage even faster performance. [28]

The practice of "rate busting" or increasing performance standards over time is the basis for many objections to monitoring. Ever-increasing standards do not have to be related to incentive pay. Standards can rise due to new technology, revised productivity goals, or for other reasons that lead management to expect better performance from employees. In the well-publicized case of one data-entry center operated by the Internal Revenue Service, employees and their union were complaining about the stress resulting from the increased pace of work. In this instance, workers were seasonal, and were invited back to work again each year based on their previous year's performance. Since the number of available jobs had declined, only above-average keyers were invited back. However, performance standards were also raised yearly, presumably to deal with the workload. Thus, each keyer was required to make an increasingly greater effort to remain "above average. "[29] An annual increase in standards has also been a cause of complaint among key entry operators in Dade County, Florida.[30]

Complaints about job stress in the U.S. Postal Service, which received a great deal of publicity in 1984 and 1985, were directed primarily at fast pace and high work standards rather than at automated equipment or the presence of monitoring per se.[31] Industrial engineers have noted since the beginning of the century that there is a limit to how much a pace can be increased, even if incentives are offered. Beyond a certain point the employees, either individually or as a group, will not perform any faster on a regular basis, no matter what the inducement. Tolerance for perceived unfair standards may depend on many factors, including the availability of other jobs. One case example noted that at three Internal Revenue Service Centers (where standards have been increased over the years), the turnover rates for key entry operators are very high; presumably workers left due to the heavy workload and fast pace required. However, the Wilkes Barre Service Center, located in an area of high unemployment, has a low turnover rate, but a high incidence of absenteeism.

Quality of Work

One problem with computerized work monitoring is that it focuses mainly on quantity or speed of work. Although a well-designed work standard should allow workers time to do a good job, some standards require such

[27] Data Entry Management Association, "Sixth Annual Member Statistical-Compensation Survey, " *DEMA Newsletter*, April 1985. The average rate for U.S. operators is 1 I ,400 keystrokes per hour, but the fastest operators can do around 25,000.

[28] Interview with Work Measurement Manager of a southern bank.

[29] Alan Westin, "Privacy and Quality of Work Life 1 ssues in Employee Monitoring," contractor report prepared for OTA, 1986; also John Harris, American Federation of (government Employees, personal communication, February 1986.

[30] "AFL-CIO Case Examples, " November 1987.

[31] For example, Peter Perl, "Monitoring by Computer Sparks Employee Concerns, " *Washington Post*, Sept. 2, 1984.

[30] "AFI.-C10 Case Examples, " November 1987.

a fast pace that workers feel quality must be sacrificed, or that the pressure to maintain both speed and quality leads to excessive stress. In a number of cases, for example, telephone operators have objected that the pressure to complete calls within the standard time prevents them from giving courteous, high-quality service. Some customers agree. On the other hand, because most operators are also subject to service observation (i.e., a supervisor sometimes listens in on calls to check for adherence to company procedures), they sometimes feel stressed because of the conflict between quantity and quality imperatives.[33]

In one mail order firm employee morale dropped and turnover rose to 80 percent after monitoring was introduced for VDT operators. "Everything was numbers, " one executive recalled, with "no attention to the downtime and slow-response-time problems of the new system, or the changes in volumes operators faced during peak periods, or of the different length and complexity of customer orders. " In addition, the pressure operators felt to speed up their work led to mistakes and improperly filled orders. This productivity system was scrapped after several years of operation, and replaced with anew approach that still collects individual operator statistics, but has standards geared to actual system operations and load cycles. In addition, as part of an overall "Quality First" campaign in this firm, the new performance standards stress "order quality" over "sheer numbers. Several dozen long-term employees interviewed for OTA said that the first productivity system was a "very bad time" at the company, but that the new approach is "fair to both company and employees, " and they have no trouble in meeting both the quantity and quality standards.[34]

Quality evaluation often requires inspection by a human supervisor, but even here computer technology can be of assistance. Some office systems allow the supervisor to view on his or her screen whatever transactions are taking place on an employee's screen. Thus supervisors can view transactions as they are taking place to check them for correctness. Computerized letter-sorting equipment used by the U.S. Postal Service has similar capability, so supervisors can periodically check each worker to be sure he or she is keying in proper zip codes.

For telephone service workers, quality checks are made by supervisors who listen in on calls to check that employees are courteous, are using proper procedures, and are giving correct information. Correct information is of interest to many firms whose representatives deal with the public, because employers may be held liable for information their employees give out over the telephone or for actions taken as a result of telephone conversations. In some cities "911" emergency calls or utility company "trouble" calls are recorded so that there will be a record of time, address, or other information for possible future use.

In some organizations employees know when their supervisor is listening, either because there is a drop in volume or because a beep tone is heard. In other cases, the monitoring equipment is completely silent. One organization was so concerned that employees not know when the supervisor was listening that supervisors were required to wear their headsets all day so that employees would not be able to guess whether they were listening or attending to other duties.

In some firms quality assurance is considered such an important function that a separate department handles it. At American Express, for example, customer service supervisors listen in on calls on an regular basis and rate the quality based on established criteria. In addition, a separate quality assurance worker listens in on calls of employees in any unit. Results are always discussed with the employee within a short time after the call.

Some workers object to service observation precisely because it is not necessarily objective. Some firms, in fact, do not have firmly established criteria for how often to listen or how to rate quality. At one government agency

[33]"AFL-CIO Case Examples, " November 1987.

[34]Alan Westin, "Privacy and Quality of Work Life Issues in Employee Monitoring, " contractor report prepared for OTA, 1986, p. 72.

there were even stories of service observation being used punitively –i.e., a supervisor listened to certain workers almost constantly, in order to accumulate enough mistakes to discipline them. This would clearly seem to be an abuse of service observation.

Service observation also invokes feelings of invasion of privacy, even though the conversation involved is not really a private one. One operator interviewed for OTA said, "When they are listening to me, I'm very upset because you can't stop it. "[35] The privacy aspect applies more clearly to the customer's side of the conversation. Some people may object to third parties overhearing their conversations. Two States, West Virginia and California, attempted to legislate restrictions on service observation. The West Virginia law required a beep tone when the supervisor is on the line as well as a published notice to customers that calls might be observed. This law was passed in 1983 but repealed in 1986. A similar law was passed in the California legislature but was vetoed by the Governor.

In the case of West Virginia there is evidence that both operator productivity and customer satisfaction remained high during the period when "secret service observation was not permitted. [36] However, several employers, particularly AT&T objected to the legislation. AT&T's threat to build its new credit management center in another State was instrumental in the repeal of the West Virginia monitoring law.[37]

Job Design and Work Process

As discussed in greater detail in OTA's report *Automation of America Offices,* new information technologies sometimes offer firms more flexibility in the way office work is designed. While many firms use computers to continue or intensify the assembly line working conditions of the industrial style of work organization, some others have experimented with new forms of organization that reinvest the jobs of individual workers or teams with more variety and responsibility.[38]

Some of these experimental organizations make use of what is called a semi-autonomous work group-a team of workers who are responsible for not only doing the work, but managing some aspects of their own work as well. In these cases, work monitoring data may still be collected, but is used by the work group as a tool for assessing its own progress.

One well-publicized example is the HOBIS (Hotel Billing Information System) office at Tempe, Arizona, in an experiment worked out jointly by AT&T and the Communications Workers of America (CWA) in 1982.[39] This office of 100 operators was reorganized according to the autonomous work group principle. It had no first-line supervisors and only one second-line supervisor in the role of advisor. Operators assumed the responsibility of supervisors, rotating through administrative duties.

The employees changed the traditional work monitoring practices. They eliminated individual measurement and remote secret service observation. Average work time (AWT) was measured only for the whole group. Service observation was performed by small groups of peers by the old-fashioned "jack-in" method, where the observer sits beside the person being monitored, listens to a few calls and then discusses the results with the employee.

It was generally agreed by CWA and AT&T that the Tempe experiment was a success: total office AWT was equal to or better than that of traditionally supervised HOBIS offices;

[35] Michael J. Smith, Pascale Carayon, and Kathleen Miegio, "Motivational, Behavioral, and Psychological Implications of Electronic Monitoring of Worker Performance, " contract report prepared for OTA, July 1986.

[36] "Results Summary, Key Service Indicators, " C&P Telephone Co. of West Virginia as of Sept. 11, 1985, supplied to OTA by Communications Workers' of America.

[37] Testimony of John D. Landers, AT&T, before the Judiciary Committee, West Virginia House of Representatives, Feb. 12, 1986.

[38] U.S. Congress, Office of Technology Assessment, *Automation of America Offices,* OTA-CIT-287 (Washington, DC: U.S. Government Printing Office, December 1985), ch. 4.

[39] This description is based on Ronnie Straw and Gregory Nichlas, "Office Automation and Autonomy: A Comparison of Choices, " Communications Workers of America, 1985; Alan Westin, "Privacy and Quality of Work Life Issues in Employee Monitoring, " contractor report prepared for OTA, 1986; Thomas Taylor, Mountain Bell Telephone, telephone interview, Apr. 16, 1986.

there were fewer customer complaints; the employee grievance rate was lower and absenteeism was lower. In addition, there were considerable savings in management salaries, and some of the money was spent on training for employees. The Tempe office was closed shortly after the AT&T divestiture for reasons completely unrelated to the experiment. Other joint labor-management experiments in alternative methods of work organization are being sponsored by CWA, AT&T, and some of the local telephone companies. For example, further experiments with semi-autonomous work groups are being carried out among AT&T operator groups in Columbus, Ohio, and south-central Florida.[40]

In a financial services firm interviewed by OTA, autonomous work groups were also considered successful. Workers were taken out of "functional" areas and organized into teams servicing the needs of certain large clients or client groups. Employees "cross-trained' one another in different jobs so that each could do a variety of work and understand the whole process. The group met together to establish productivity goals. Although this firm maintained a more traditional management structure within each group and still applied individual measurement to some jobs, officials and employees believed that the reorganization, teamwork, and greater diversity of work greatly improved both productivity and quality of working life.[41]

Supervision and Evaluation

A few researchers have attempted to compare how perceptions of closeness of supervision, emphasis on performance measures, and job satisfaction differ in monitored and nonmonitored workers. This is a difficult task because so many other cultural, job design, and environmental factors can overshadow the effect of electronic monitoring.

One researcher who studied data-entry operators, claims processors, and data collectors (telephone interviewers and collection agents) and their supervisors, found no significant pattern of differences between the monitored and nonmonitored sites.[42] The differences she did notice were between unionized and non-unionized locations. The workers in unionized locations were better informed about VDT health issues and more willing to ask questions and state opinions during informal workshops held after their survey forms were complete. She found, however, their concerns encompassed a variety of VDT health issues, including vision problems, workstation design, and reproductive hazards; monitoring did not emerge as the major focus of concern.

Another study found that in both monitored and nonmonitored sites, roughly half the workers (47.8 and 46.3 percent respectively) expressed satisfaction with the evaluation process.[43] Among the monitored workers, 17.3 percent were not satisfied and 34.7 percent were neutral. Among the nonmonitored workers, 28 percent were not satisfied and 25 percent were neutral (see table 5). In reviewing the supplementary comments made by interview subjects, the authors found clear differences in the causes of dissatisfaction. At the monitored sites, nearly all dissatisfaction was directed at the electronic monitoring system; at the nonmonitored sites it was directed at a number of causes, including supervisors, lack of standards, unfair evaluations, and the like.

This study also found that workers at monitored sites tended to believe that their evaluations overemphasized quantity and underemphasized quality, tended to see their rewards as closely tied to their evaluations, and thought that level of supervision was too close. The majority of workers in both groups felt they had little participation in workplace de-

[40]Communications Workers of America and AT&T Communications, *The Emergence of Second Generation Quality of Work Life Models in AT&T Communications: A Pilot Study*, February 1986.

[41]OTA interviews, November 1985.

[42]Elaine J. Eisenman, "Employee Perceptions and Supervisory Behaviors in Clerical VDT Work Performed on Systems That Allow Electronic Monitoring, prepared for Educational Fund For Individual Rights and submitted as a contract report to OTA, 1986.

[43]R. H. Irving, C.A. Higgins, and F.R. Safayeri, "Computerized Performance Monitoring Systems: Use and Abuse, *Communications of the ACM*, August 1986.

Table 5.—Comparison of Monitored and Nonmonitored Workers

Dimension	Monitored	Percent	Not monitored	Percent	Total	Chi-Sq	(df)	(p)
Satisfaction:								
Not satisfied	8	173	23	280	31			
Neutral	16	347	21	25.6	37			
Satisfied	22	478	38	46.3	60			
Total	46		82		128	2.25	2	p O 3247
Emphasis on performance measures:								
Quantity								
Underemphasized	0		16	20.2	16			
Appropriate	19	380	45	56.2	64			
Overemphasized	31	62.0	19	23,7	50			
Total	50		80		130	2379	2	p 0001
Quality:								
Underemphasized	22	44.0	15	20.2	37			
Appropriate	19	380	45	56.2	64			
Overemphasized	5	83	1	1,4	6			
Total	50		74		124	15,3	2	p 00005
Characteristics of feedback:								
Amount of feedback:								
Not enough	21	428	41	45,0	62			
Enough	22	448	41	45.0	63			
Too much	6	124	9	9.8	15			
Total	49		91		140	0.20	2	p O 9048
Usefulness of feedback								
Not useful	8	170	13	142	21			
Adequate	13	276	20	21.9	33			
Useful	26	55,3	*58*	637	84			
Total	47		91		138	0.93	2	p O 6281
Importance of evaluation for rewards:								
Not Important	2	4.3	18	222	20			
Marginal importance	3	65	8	9.8	11			
Important	41	891	55	67.9	96			
Total	46		81		127	8.08	2	p --00176
Closeness *of supervision:*								
Not close	16	326	38	417	54			
Acceptable	10	204	36	39.5	46			
Too Close	23	469	17	18.6	40			
Total	49		91		140	1314	2	p 00014
Participation in evaluation process:								
Low participation	30	65,2	50	62.5	80			
Average	8	173	11	13,7	19			
High participation	8	173	19	237	27			
Total	46		80		126	0.84	2	p 0.6570

SOURCE: R.H. Irving, C.H. Higgins, and F.R. Safayeni, "Computerized Performance Monitoring Systems: Use and Abuse," *Communications of the ACM*, August 1986, p. 796

cisions. This study found little evidence that workers opposed computer monitoring in principle; their chief problems were not with the technology itself but with the way it was used by management.

Personal Computer Monitoring

Most electronically monitored work is performed on workstations attached to mainframes or minicomputers. Yet personal computer (PC) use is growing rapidly, especially among professional and managerial workers. OTA did not find examples of production monitoring of workers using PCs, but there was considerable interest and controversy over privacy of an employee's PC files and the right of employers to inspect them.

Three primary areas of employer interest in PC monitoring have already surfaced:

1. abuse of PCs (using company resources for personal purposes),
2. confidentiality (security breaches), and
3. violation of legal/regulatory duties in use of client or employee data.

Of the 10 firms interviewed for OTA regarding PC monitoring, none were doing any inspections or searches of PC-user disks or files. All of them, however, said they felt they had the legal right to do so, and would not hesitate to do so if a specific rule violation or compromise were suspected. A typical comment by one information system director was:

> We have issued a policy guide for privacy and security compliance in PC use, and have stated that the company reserves the right to inspect all PC files and materials bought by the company and used here for our business purposes. But we haven't felt it wise or necessary to swoop down on people and demand to see what they have on their disks.

On the other hand, representatives of all 10 firms said their organizations audited transactions done by PCs interacting with databases on other computers. These were part of the regular, user-password-based security procedures of mainframe/database management. The monitoring consisted of: 1) following up on any unusual use patterns indicated in regular audit-trail records; or 2) ad hoc inspections of audit records to identify use levels and patterns. End users are informed (in all the organizations) that such auditing is conducted.

As for assuring end-user compliance with legal and regulatory rules governing an organization's handling of client or employee personal data, 4 of the 10 organizations reported they had issued written policies to PC end-users restating such requirements (e.g., Fair Credit Reporting Act; State employee access to personnel records laws; confidentiality of medical information laws; etc.). However, none of the 10 firms reported having done surprise or announced inspections of disks or other desk-held file materials. Interviews with officials of the Inspector General's office of General Services Administration (GSA) indicate that inspectors from GSA and other agencies' Inspector Generals have inspected PC disks of government employees. These audits have been done both to determine that computers are being used for official purposes and to ensure that confidential information is being properly used and properly protected.[44]

Monitoring and Stress[45]

One area in which electronic monitoring may have far-reaching implications is in the area of health effects. A number of authors have noted the likelihood of a link between electronic monitoring and physical and psychological stress. Many of the published stories of oppressive, heavily monitored workplaces cite the overwhelming fear, anxiety, hatred, and loss of self-image that workers suffer. Many authors have stated that there must be a link between monitoring, stress and health problems, absenteeism, and lowered productivity.[46]

Stress is now recognized as a major occupational health problem. Stress-related symptoms have been estimated to cost U.S. industry $50 to $75 billion per year in absenteeism, company medical expenses, and lost time.[47] Statistics indicate that claims for worker compensation, based on disability due to gradual accumulation of stress, have been growing rapidly during the 1980s.[48] For workers under

[44] Interview with Don Sheridan, Office of Inspector General General Services Administration, Dec. 16, 1986.

[45] This section draws heavily from Michael J. Smith, Pascale Carayon, and Kathleen Miezio, "Motivational, Behavioral, and Psychological Implications of Electronic Monitoring of Worker Performance," contractor report prepared for OTA, 1986.

[46] See, for example, Tim Healy and Peter Marshall, "Big Business is Watching You," *In These Times,* Feb. 26-Mar. 11, 1986; Arlene Hershman, "Corporate Big Brother is Watching You," *Dun's Business Month*, January 1984; Robert Howard, *Brave New Workplace (New* York, NY: Elizabeth Sifton Books-Viking, 1985); Peter Perl, "Monitoring by Computers Sparks Employee Concerns," *The Washington Post,* Sept. 2, 1984; Peter Perl, "Watching the Workplace: High Tech Methods Boost Productivity, But at a Cost," *The Washington Post,* Sept. 3, 1984.

[47] Robert Arndt and Larry Chapman, "Potential Office Hazzards and Control," September 1984, report prepared for OTA project on Preventing Illness and Injury in the Workplace, p. 30.

[48] National Council on Compensation Insurance, "Emotional Stress in the Workplace–New Legal Rights in the Eighties," 1985.

age *40*, claims related to stress exceeded claims related to other occupational disease in 1985.[49] These claims are from workers of all kinds, including managers and supervisors, who are less likely than other workers to file claims for physical injuries. To the extent that electronic monitoring is associated with stress, then it must be viewed as contributing to an important health hazard.

According to the view most frequently cited in the literature, the presence of stress can be inferred in an individual from a very generalized physiological response pattern. [50] Symptoms include increases in adrenaline secretion, the dumping of sugar into the bloodstream, and other related physiological processes. These symptoms can be provoked by a variety of environmental agents and situations, such as drugs, fear, and job ambiguity. While there is nothing wrong with physiological arousal per se, it can, if chronic, produce serious degenerative effects due to wear and tear on the body. Thus, stress provides a basis for the development of various illnesses called "diseases of adaptation, " since they are not a direct function of the agent or situation that elicited the response pattern, but a consequence of the body's adaptive reaction.

A *1982* journal article suggests that job factors can create stress and lead to chronic disorders. [51] The author states that individuals may perceive the demands imposed by the environment as either stressful or not stressful, depending on factors such as prior experience, current emotional status, health status, and genetically predisposing features. If demands are perceived to be stressful, then acute biological and emotional responses occur, which, if they continue to occur with some consistency over a prolonged period of time, can eventually lead to disease. Various intervening factors, which determine the potential for disease to develop, include individual coping style, genetic predisposition to disease, and emotional support from others.

Although there has been some research on the health effects of office automation, there has been little research attempting to draw a direct link between electronic monitoring and stress. There are theoretical grounds for postulating a link between monitoring and stress, and the few studies that have been done suggest that monitoring may be stressful. Unfortunately, none of these studies have successfully separated the effects of computer-based monitoring from the combined effects of other stressors.

Although there is no clear scientific validation of a link between electronic monitoring and stress, several surveys have found higher incidence of stress among people in monitored jobs. One survey that attempted to look directly at stress and health outcomes of work monitoring was the 1984 National Survey on Women and Stress, conducted by the 9 to 5 National Association of Working Women. As noted above, this survey includes one question directly related to monitoring: "Is your work measured, monitored, 'constantly watched' or 'controlled' by machine or computer system?' When the health problems experienced by women who answered "yes' to this question are compared to those of all respondents, as shown in table 6, they show a consistently higher experience of stress-related illnesses. Respondents whose work was subject to computerized monitoring were also more likely to rate their jobs as "very stressful. Forty nine percent of them rated their jobs as very stressful, compared to 33 percent of all respondents. Seventy-four percent of the monitored workers reported strain, stress, or pressure "often or always" in the previous month, compared with an overall rate of 63.5 percent for all respondents. [52]

A related question in the 9 to 5 survey asked about production quotas. Almost half (47.4 percent) of the women working under production

[49] Ibid.

[50] Hans Selye, *The Stress of Life (New* York, NY: McGraw-Hill, 1956).

[51] L. Levi, "Methodology Considerations in Psychoendocrine Research, *Acta Medica Scandinavia*, 1982, 191, Supplement 528, pp. 28-54.

[52] 9 to 5 National Association of Working Women, "The 9 to 5 National Survey on Women and Stress—Office Automation: Addendum, " 1984, pp. 4-5.

Table 6.—Rates of Frequent Health Problems Related to Computerized Monitoring of Work Performance

Respondents answering the question: "Is your work measured, monitored, constantly watched, or controlled by machine or computer system?"

	Health problems experienced two to three times per week or more/daily								
	Headaches	Nausea, dizziness	Exhaustion, fatigue	Digestive problems	Chest pain	Anxiety, nerves	Anger	Depression	Medical problems
Yes (358 of all respondents)	31.0%	9.83%	49.40%	25.9%	9.75%	40.34%	39.20%	32.2%	40.5%
No (1,705 responses)	24.7	5.54	38.33	17.8	5.40	31.15	28.44	20.0	32.0
Rate for all respondents	24.2	6.70	39.70	19.0	5.60	31.90	28.50	20.8	31.6
Chi square probability ratio	0.0201	0.0033	0.0001	0.0008	0.0333	0.0001	0.000	0.0001	0.0019

SOURCE: Nine to Five National Association of Working Women, The Nine to Five National Survey on Women and Stress: Office Automation Addendum, 1984

Table 7.—Rates of Frequent Health Problems Related to Production Quotas or Productivity Standards

Respondents answering the question: "How often does the following statement describe your job? I am required to complete a certain amount of work per hour or per day, e.g., a certain number of keystrokes, forms, or items to process."

Health problem two to three times per week or more/daily	All respondents	Never (3,135)	Sometimes (761)	Often (334)	Always (443)	If ever (1,531)
Eyestrain	20.2%	17.8%	23.3%	23.4%	27.4%	25.0%
Headaches	24.0	22.3	25.3	28.0	28.7	27.14
Nausea/dizziness	6.2	5.6	6.5	7.6	8.9	7.4
Insomnia	17.6	15.4	21.5	20.9	24.2	22.1
Muscle pain	38.6	35.5	42.6	45.2	49.3	43.2
Exhaustion/fatigue	39.7	35.7	44.4	47.6	56.0	48.4
Digestive problems	18.8	16.7	20.8	22.8	26.8	23.0
Chest pain	5.7	4.4	7.0	7.8	10.9	8.3
Nerves, tension, anxiety	31.2	28.0	34.3	39.1	41.8	37.7
Anger/irritability	27.4	24.7	30.3	32.5	37.6	32.9
Depression	20.0	16.7	24.3	29.3	28.7	26.6
Medical problems	31.6	29.9	34.7	34.4	36.3	35.1
Lost work time	20.9	19.3	23.4	24.1	25.4	24.1

Base is all [illegible] employed respondents

SOURCE: Nine to Five National Association of Working Women, The Nine to Five National Survey on Women and Stress: Office Automation Addendum, 1984

standards reported that their work was measured or monitored by a computer. For the others, work is presumably counted by supervisors or by the workers themselves. Women working under production standards were more likely to rate their jobs as very stressful (48.1 percent if always under standards, 41 percent if often, 29.2 percent if never). Their experience of stress-related illness, as shown in table 7, was higher than the experience of all respondent s.[53]

These results are consistent with other research suggesting that monitoring induces pressure to perform. Some managers may feel that this is a desirable effect, since it implies high production. But occupational stress research indicates that excessive work pressure is not conducive to good long-term performance and brings about adverse health consequences." In fact, there are a range of stressful working conditions that may be related to electronic monitoring of employee performance. These include heavy workload, especially of repetitive or machine-paced tasks; routinized work activities; lack of control over timing, speed, and variety of tasks; and social isolation, including lack of peer social support, reduced supervisory support, and fear of job loss.

There are many potential causes of stress in the workplace, and it is not clear from worker compensation claims that work monitoring is a dominant one. However, a review of mental stress worker compensation claims from the State of Oregon shows that a little under one-fifth of the total claims were made by people in occupations where monitoring is common. Worker compensation records do not release the detailed cause of injury or the detailed job description of the claimant, so it is impossible to determine if electronic monitoring was actually a factor. Of the *542* cases listed, about 102 (18.8 percent) were in occupations where electronic monitoring is fairly common. These occupations include clerks (of various kinds), insurance adjustors, bank tellers, telephone operators, dispatchers, and retail sales workers. The rate of acceptance and denial of claims is shown in table 8. The acceptance rate for potentially monitored office occupations was roughly the same as for all jobs, *34.2* and *35.2* percent respectively.

Other studies have found a high incidence of stress-related illness among workers most likely to experience electronic monitoring, even though monitoring itself was not examined as a variable. For example, a study by the National Institute of Occupational Safety and Health found that secretaries had the second-highest incidence of stress-related illness among 22,000 workers. The Framingham heart study, released in 1985, found that women clerical workers develop coronary heart disease at nearly twice the rate of other women workers." Researchers have commented that the stress-provoking factors in these jobs are rapid work pacing, including machine pacing, monotonous or repetitive work, and lack of discretionary control.

[53] Ibid.

[54] C.L. Cooper and J. Marshall, "Occupational Sources of Stress: A Review of the Literature Relating to Coronary Heart Disease and Mental 111 Health," *Journal of Occupational Psychology* 49, 1976, pp. 11-28.

[55] Working Women Education Fund, "Health Hazards for Office Workers," April 1981.

Table 8.—Review of Oregon Worker Compensation Claims Involving Mental Stress January 1985 Through September 1986

Occupations	Number of claims	Accepted	Percent accepted	Denied
All occupations	542	191	35.2	351
Possibly monitored occupations:				
Office [a] (percent of total 13.4)	73	25	34.2	48
Retail sales (percent of total 5.3)	29	11	37.9	18

[a] Occupations, in order of decreasing frequency, are clerk (39), Insurance adjustor (10), dispatcher (9), administrative support (5), computer operator (4), data entry (2), bank teller (2), telephone operator (2)

SOURCE Oregon Worker's Compensation Department, Research and Statistics Sect Ion, "Accepted and Denied Claims Involving Mental Stress, Oregon, 1/85.9/86

Time pressure, such as having to meet deadlines, is another significant factor in stress. Studies have shown increases in stress level as difficult deadlines draw near.[56] The experience of deadline pressure on a constant basis, as might be the case in a fast-paced monitored job, may be more damaging than deadline pressure experienced on an occasional basis.

Two organizational factors have been shown to be of special significance for increased job stress and decreased worker health. These are: 1) job involvement or participation; and 2) organizational support, as reflected by supervisory style, support from managers, and chances for career development. Lack of participation in work activities has been demonstrated to result in increases in negative psychological moods.[57] In terms of organizational support, it has been shown that close supervision and a supervisory style characterized by constant negative performance feedback are related to high levels of stress and poorer worker health.[58] The implication of these findings is that excessive, impersonal electronic monitoring of employee performance that produces close supervision and constant negative performance feedback could promote worker stress.

It has also been demonstrated that workers' feelings of lack of involvement are related to stress and that prolonged stress can be related to health complaints.[59] Electronic monitoring has a propensity for reducing worker feelings of job involvement and may in this way increase worker distress. The chances to participate and be involved in the job process may be diminished in work systems that are driven by employee performance monitoring.

Reduced coworker support can also contribute to stress. Monitored workers in several studies, and those interviewed by OTA stated that, due to their production standards and the electronic monitoring system, they had no opportunity to interact with coworkers.[60]

One study of work monitoring in the telecommunication industry suggests that the possible connection between monitoring and job-related stress is through the changed structure of the work. In this study, no direct correlation was found between electronic monitoring and stress-related illness. However, a correlation was found between monitoring and low job control which has been found, in other studies, to be associated with stress-related illness. The conclusion reached by the researchers is that when jobs are redesigned to facilitate computerized monitoring of work performance, they are also reshaped in ways that increase the degree to which management directs both the pace and the method of work.

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[56]M. Friedman, R.H. Rosenman, and V. Carroll, "Changes in the Serum Cholesterol and Blood Clotting Time in Men Subjected to Cyclic Variation of Occupational Stress, " *Circulation,* 1958, pp. 852-861.

"B. Margolis, W.M. Kroes, and R. Quinn, "Job Stress: An Unlisted Occupational Hazard, *Journal of Occupational Medicine 16, 1974,* pp. 654-661. R.D. Caplan, S. Cobb, J.R. P. French, R.V. Harrison, and S.R. Pinneau, *Job Demands and Worker Health* (Washington, DC: U.S. Government Printing Office, 1975). M.J. Smith, B.G. Cohen, and L.W. Stammerjohn, "An Investigation of Health Complaints and Job Stress in Video Display Operations, " *Human Factors 23, 1981,* pp. 387-400.

[58]R.D. Caplan, S. Cobb, J.R.P. French, R.V. Harrison, and S.R. Pinneau, *Job Demands and Worker Health* (Washington, DC: U.S. Government Printing Office, 1975). M.J. Smith, B.G. Cohen, and L.W. Stammerjohn, "An Investigation of Health Complaints and Job Stress in Video Display Operations, " *Human Factors 23, 1981,* pp. 387-400.

[59]World Health Organization, *Psychosocial Factors and Health: Monitoring the Psychosocial Work Environment and Workers' Health* (Geneva: 1984). J. Rutenfranz, W. Colquhoun, P. Knauth, and J. Ghata, "Biomedial and Psychosocial Aspects of Shiftwork, *Scandinavian Journal of Work Environment and Health 3,* 1977, pp. 165-182. R.A. Karasek, Jr., "Job Decision Latidute, Job Design, and Coronary Heart Disease, in G. Salvendy and M.J. Smith (eds.), *Machine Pacing and Occupational Stress* (London: Taylor & Francis, 1981), pp. 45-56. R.D. Caplan, S. Cobb, J.R.P. French, R.V. Harrison, and S.R. Pinneau, *Job Demands and Worker Health* (Washington, DC: U.S. Government Printing Office, 1975). M.J. Smith, B.G. Cohen, and L.W. Stammerjohn, "An Investigation of Health Complaints and Job Stress in Video Display Operations, " *Human Factors 23, 1981,* pp. 387-400. B. Garden, "Technology Alienation and Mental Health, " *Acta Sociologica 19, 1976,* pp. 83-94. B. Margolis, W.M. Kroes, and R. Quinn, "Job Stress: An Unlisted Occupational Hazard, " op. cit. S.G. Haynes and M. Feinleib, "Women, Work and Coronary Heart Disease: Prospective Findings From the Framingham Heart Study, *American Journal of Public Health 70, 1980,* pp. 133-141. M.J. Colligan, J.J. Smith, and J.J. Hurrell, "Occupational Incidents Rates of Mental Health Disorders, " *Journal of Human Stress 3, 1977,* pp. 34-39.

[60]For example see R.H. Irving, C.A. Higgins, and F.R. Safayeri, "Computerized Performance Monitoring Systems: Use and Abuse, " *Communications of the ACM,* August 1986. Interviews in Michael J. Smith, Pascale Carayon, and Kathleen Miegio, "Motivational, Behavioral and Psychological Implications of Electronic Monitoring of Worker Performance,, " contract report prepared for OTA, July 1986.

This lack of personal control, in turn, places workers at significantly greater risk of ill health."

Computer Pacing and Stress

Machine pacing is different from computer monitoring. The work of a directory assistance operator offers an example of a "low control job, ' one that is both paced and monitored by computer. A computer-controlled distribution system passes a call to an operator. He or she greets the customer, hears the name to be looked up, and keys it into a computer terminal. Once the proper information appears on the screen, the operator presses a key to release the call. A voice synthesizer actually reads the telephone number to the customer. Once the call is released, the distribution system presents another call to the operator.

The job is *monitored,* in that records are kept on the operator's performance within each call-the time to respond to the call, locate the proper information, and release the call (summarized as average work time or AWT). In addition, the job is also *machine paced* in that the cycle time between calls is controlled by the computer, not by the operator. Work pressure increases if that cycle time is very short.

It has been noted that new technology has turned the job of directory assistance operator into a literally thankless task. Not only is the pace hectic, but because the operator releases the call before the customer receives the needed information, the operator never hears customers say "thank you. " Job design factors, along with the fast pace, probably greatly contribute to stress in this job.

Machine pacing has been implicated as a significant factor in ill-health among factory workers. Computers—which can operate at high speeds on a continuous basis—have increased the pacing impact on office workers. Recent research suggests that pacing produced by computer-driven video display systems may have an even greater stress effect than traditional factory pacing.[62]

Feedback and Motivation[63]

Perhaps the best use of information about an employee's performance is to give it back to the employee. One advantage that electronic measurement can offer to workers is accurate and timely information about their own performance. Studies of feedback, whether related to simple sensory feedback or to higher levels of feedback related to knowledge of results, all indicate that people want to know about their performance and will seek out such knowledge when it is absent.[64]

Immediate sensory feedback helps employees to exert better control over skilled actions and to correct errors.[65] For example, the feel of the keyboard and the display of the characters on the video screen help a data entry or word processing operator to know that data is being keyed properly. This type of feedback is continuous throughout the task.

A higher level of feedback, knowledge of results, occurs when a task is completed and evaluated against some external standard, and the results are fed back to the employee; "You have produced 10 percent over the production goal today, " or "Your output had 2 percent errors. This kind of feedback provides direction to the worker about future output.

Feedback about one's own activities can be

[61] te\en P. Vallas and William V. Calabro, "Occupational Conditions and Worker Health in the Communications Industry, " New York Institute of Technology, Human Resources Development Center, no date.

[62] M.J. Smith, B.G. Cohen, and L.W. Stammerjohn, "An Investigation of Health Complaints and Job Stress in Video Display Operations, " *Human Factors 23, 1981,* pp. 387-400. A. Cakir, H. Reuter, L. Von Schmude, and A. Armbruster, *Investigations of the Accommodations of Human Psychic and Physical Functions to Data Display Screens in the Workplace* (Berlin: Institute fur Arbeitswissenscharft der Technician Universitat Berlin, 1978).

[63] This section draws heavily from Michael J. Smith, Pascale Carayon, and Kathleen Miegio, "Motivational, Behavioral and psychological Implications of Electronic Monitoring of Worker Performance,, " contract report prepared for OTA, July 1986.

[64] S.J. Ashford and L.L. Cummings, "Feedback as an Individual Resource: Personal Strategies of Creating Information, *Organizational Behavior* and Human *Performance* 32, 1983, pp. 370-398.

[65] K.U. Smith and M.R. Smith, *Cybernetics Principles of Learning and Education Design (New* York, NY: HoIt, Rinehart & Winston, 1966).

a very powerful motivator and has been found to have a strong influence on productivity, and in some cases on job satisfaction as well. People like to do a good job, but without information they often don't know whether they are doing one or not.

Because computer technology is adept at gathering and correlating information, it can be very useful in giving timely feedback to workers in a useful form. For example, office systems can be designed to give performance information to workers as well as to supervisors. In some firms, for example, customer service representatives can get private access to their own recent performance by keying the proper code into their workstations.[66] Any information that is available to their supervisor is available to the individual workers, as well as comparisons with the group average and the standards.

A recent study reviewed 42 case histories and found that without exception people performed better when they were given some objective, quantitative feedback about their own performance or output. This study did not focus on electronic work measurement, but rather on both manual and electronic methods in a variety of work settings, including banks, payroll offices, reservation offices, manufacturing facilities, and health care facilities. The form in which feedback was given also varied from one setting to another. The three methods most commonly used were private individual feedback, public individual feedback, and public group feedback. In some cases, objective feedback was combined with other interventions such as praise, public recognition, or additional training; but positive results were also noted where feedback alone was provided.[67]

Feedback may serve as both a motivator and an instructional device. When people receive what they perceive as objective feedback, they can compare what they actually did to: 1) what they thought they did and 2) what they are expected to do. In some cases it may correct misconceptions or inaccurate perceptions about what they are doing. In one example, airline reservation clerks were provided with profiles of their verbal behaviors based on sample recordings of their telephone conversations with customers. One clerk commented on seeing the feedback:

> When asked previously whether I used the customer's name I would have said-and believed–"Of course, we were trained to do that. " I was really surprised when I saw objective evidence on how little I was actually doing it.[68]

As a result of the feedback, use of the customer's name by the clerks rose by 87.5 percent, while the clerks' interrupting of customers (a habit the employer wished to discourage) nearly disappeared.

Feedback is an effective modifier of behavior if it is seen as a valued commodity by the recipient and if it is timely. It takes on value to the individual when it is effective (relevant, understandable, accurate, useful) and when it comes from a trusted or highly regarded source. Although feedback need not be immediate or continuous, it should be given frequently. The longer the delay, the less effective it is in affecting performance.[69] A number of the workers interviewed for OTA expressed a desire for more frequent feedback about their work. They also thought that feedback information from the electronic monitoring system could be better designed to help them gain more control of their work.

If employees perceive that rewards and/or punishments could ensue from an evaluation of their performance, they are especially interested in feedback. They want to understand the basis of rewards and punishments, and feedback helps to resolve feelings of ambiguity or uncertainty.

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[66] Interviews at American Express Southern Regional Operations Center.

[67] Richard E. Kopelman, *Managing Productivity in Organizations: A Practical, People-Oriented Perspective (New* York, NY: McGraw Hill, 1986), pp. 163-187.

[68] Ibid., p. 176, citing Stephen A. Allen, "Aer Lingus—Irish (B)" case #9-477-640 (Boston, MA: Intercollegiate Case Clearinghouse, 1976), p. 7.

[69] M.J. Smith, B.G. Cohen, and L.W. Stammerjohn, "An Investigation of Health Complaints and Job Stress in Video Display Operations, " *Human Factors* 23, 1981, pp. 387-400.

At the same time, feedback of performance can create feelings of anxiety, frustration, and lowered self-esteem. Since feedback fulfills an error-correction function as well as a performance-appraisal function, it can indicate to employees that they are not doing their job as well as they would like to, or as well as the employer would like them to. This can create stress, even when it resolves the stress associated with uncertainty and ambiguity. In short, feedback is a two-edged sword insofar as stress is concerned.

Feedback is necessary to groups as well as individuals, and computer monitoring systems can also give workers immediate information about the work environment letting them know how their work group is doing right now, and how they can best contribute.

To take telephone customer service again as an example, some offices have clearly visible displays on the wall that show the number of incoming telephone calls waiting to be answered and the age, in seconds, of the oldest call. Such displays could be used as weapons of callous management to keep constant pressure on agents of understaffed offices. However, in a properly staffed office, where peaks of incoming calls occur for a few minutes at a time, a few times a day, status displays become tools in the hands of the work group. People know how to pace their work. When the display shows all zeros, agents feel freer to take a little extra time with a difficult caller, to catch up on paper work, or to take a break. When many calls are backed up, they can make an extra effort to finish a call quickly, or perhaps to defer a break for a few minutes rather than abandon their colleagues in a crunch.

Team spirit and friendly competition can be powerful motivators, and both employers and employees can benefit if they are not abused. However, workers can also perceive employers' use of feedback and social pressure to be unfair and manipulative. A Pacific Western Airlines (PWA) productivity campaign drew union protests when company posters urged reservation clerks to:

> Compare yourself with your friends. Compare yourself with ones who aren't your friends. Are you pulling your weight at the office? When the monthly statistics are published, ensure you're not dragging down your team and your office.

The union newsletter charged PWA with setting workers against each other, and called the campaign a "new low in . . . degradation."[70]

[70] Lawrence Archer, "I Saw What You Did and I Know Who You Are," *Canadian Business*, November 1985, p. 81.

THE FUTURE OF WORK MONITORING

The OTA report on *Automation of America's Offices* pointed out some trends in the growth of computer-based office automation equipment that have implications for the future of work monitoring.

One trend was the inevitable movement toward direct machine-to-machine communication. Increasingly, data will be captured in machine-readable form at the point of origin, customers will enter their own data (as with automatic teller machines) information will be recorded using optical scanning and voice recognition, and different computer systems will talk directly to each other, thus reducing the need to keyboard data.

Another trend was the growth in the introduction and use of office automation equipment and its rapid adoption by all sectors of the economy. It is estimated that by the year 1990 there will be one computer terminal for every three workers in the United States; by the year 2000, terminals may be as common in offices as telephones.

Both of these trends suggest possible changes in the population of workers that will be af-

fected by computer-based work-monitoring technology. For example, the prime example of the monitored job today is that of the data-entry operator, but over the next 20 years the growth rate of data-entry workers is expected to slow or perhaps decline. Those that remain will probably still be monitored, but they will be a smaller proportion of the office work force.

The other trend—towards wider use of computer-based office equipment–suggests that more jobs will be at least partly automated or dependent on the use of a computer. As a result, more types of jobs will be possible candidates for electronic monitoring. Although the characteristics of monitored jobs listed at the beginning of the chapter (repetitive tasks, high volume of work, low training requirement, high tolerance for turnover, ample labor supply) describe ideal conditions for monitoring, they are not absolutes. It is already possible to apply electronic monitoring to some highly skilled professional and management positions. Some times monitoring has not worked well in high-level positions. Employee resistance may have caused management to back down on implementation plans, or, as in the case of bank loan officers interviewed by Westin, employees may have found ways to "game" the system by feeding it false information.[71] The costs and importance of employee resistance can change over time, however. If at some future time management determines that the benefits to be generated from monitoring a particular job category will outweigh possible costs in higher turnover, monitoring systems are likely be introduced. And while professionals may be able to defeat their current monitoring system, a system that automatically collects correct information could be designed if their employer ever decides it is worth the cost.

The growing use of computer-based management information systems also means that more managers will be subject to closer monitoring, simply because more of their day-to-day decisions will be revealed to superiors through the computer system, rather than waiting for monthly or quarterly reports.

If there is a growth in computer monitoring, or a spread to other types of work, it does not necessarily mean a devaluation of office work. Computer-based monitoring can offer advantages to employees, for example, improved feedback and better control of their own work. Professional and managerial workers may be able to use their bargaining power with employers to participate in decisions about the redesign of their jobs or the implementation of work measurement and monitoring, as to assure fair use of monitoring. As with other examples of technology in the workplace, many nontechnological factors, including management and employee attitudes, corporate culture and relative power relationships, will govern how the technology is used.

[71] Alan Westin, "Privacy and Quality of Life Issues, " Alan Westin, "Privacy and Quality of Work Life Issues in Employee Monitoring, " contractor report prepared for OTA, 1986.