# INTEGRATED INFORMATION SYSTEMS:
# WORK DESIGN AND ERGONOMIC ISSUES

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## Introduction

Ever since the first digital computers were conceived in the 1930's people have wondered about the consequences these machines would have for workers. Would they result in deskilling of jobs and a significant reduction in the number of positions available? Or, would the use of computers in the work place lead to expanded opportunities and improved work life quality through the development of tools that augment human capabilities?

Early writers, for example Wiener [Wiener 54], suggested that workers would be replaced almost completely by automated factories, prompting an outcry from organized labor. Behind many people's reaction to computers is the notion of a machine capable of exhibiting human thought. Given the ability to execute a sequence of instructions (a program), to store and retrieve them, there appeared to be no limit to what a computing machine could accomplish.[1] This is a mechanistic and restricted view of human thought disputed by many philosophers and computer scientists alike.[2]

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[1]This view of human thought is often expressed in the form of a hypothesis: that being a symbol manipulation system - e.g., having the basic capability of reading, writing, storing, erasing and storing symbols, and branching as a result of comparison - is a necessary and sufficient condition to do what is called "thinking" [Simon 81].

[2]See, for example, Joseph Weizenbaum's [Weizenbaum 83] comments about the fifth generation computer project.

One of the first empirical studies of the subject, performed by Mann and Williams [Mann 60], investigated how the move to an automated system affected workers in the accounting and sales departments of a large utility. The authors observed that after a period of dynamic change, brought about by the introduction of computer based transaction processing and record keeping systems, a state of relative equilibrium emerged characterized by:

1. Increased level of formalization. Rules and regulations were substituted for individual decision making.

2. Autonomy for setting work pace was reduced for both individuals and work groups. For example, work could no longer be held from one day to the next.

3. Control became more centralized. It was vested in fewer positions.

4. Interdependence among workers increased and there was greater need for coordination. For example, a breakdown in one part of the operation affected the other part's ability to do their job.

5. Workers became more accountable for their work because errors were more visible (that is, more easily detected and traceable).

6. A number of jobs were eliminated and there was some reduction in specialization (that is, some jobs were combined into an enlarged job). There was no change, however, in the departments' average job grade.

7. The new system permitted a reduction in cost.

The authors' were careful to point out that they could not tell whether the aggregate effect of these changes were positive or negative for either individuals or the organization. They did conclude, however, that changes in jobs were substantial, but uneven in their effect; the dislocations and changes in duties were serious problems for some workers, for others, the changes were a game.

This ground breaking study formed the context in which the question has been considered for the past twenty years[3]. Although many investigations have been performed, the mixed findings suggest that few conclusions or generalizations can be reached. What has emerged is that outcomes can not be determined as a foregone conclusion. There are significant consequences for both the *content* of work, the *level* of employment, and the *quality* of working life. Specific consequences, however, are situational.

In this chapter models of computer mediated work will be described along with some of the findings of previous studies. One model, based on the notion of work tasks as intervening

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[3]Although the study provided insight into the types of changes associated with the use of computer systems in work settings, it, never the less, has shortcomings. Studies done in one setting can not be generalized to another. Then, since it was performed early in the life cycle of computer technology, it may not faithfully reflect changes that occur with mature technology. We have come to understand that the approach and methods used to implement a technology have a great deal to do with how people react to it, and there was little consideration of this in the Mann and Williams study. No standard measures of the task environment were applied, so that it is difficult to compare these results with those of later studies. Finally, little consideration was given to how the technology interacts with working life quality, a major concern of researchers and managers today.

variables, is particularly well suited to investigations of the relationship between computer-based systems and stress related outcomes. The results of studies based on this model suggest some of the mechanisms by which technostress occurs. Once the causes of technostress are determined, various strategies for coping and compensating can be considered. This topic is considered at the end of the chapter.

**Models of Computer Mediated Work**

Early studies of the impact of computer-based systems on workers took a machine centered approach. The main idea was that the presence of a computer in a work setting would *directly* change outcomes, such as worker attitudes about their job, or their performance. These studies did not differentiate types of computer systems, or even features of application systems. And they did not take into account the intensity with which workers used a system. For example, Shepard [Shepard 71] compared computer operators with workers, in roughly the same grade, who did not use computers, to see whether there was a difference in the degree of their alienation (none was found).

As might be expected, the results of these studies were mixed; some showed that workers' attitudes became poorer while others indicated that they became better. No consistent pattern emerged. It was soon realized that this model was too simple; it did not take into account a whole variety of factors that had been shown by researchers in organization behavior to be related to outcomes. Furthermore, no one could convincingly explain why the presence of a computer in a work environment, in and of itself, should alter people's attitudes about their jobs.

Partially to remedy these deficiencies, researchers began to adopt a contingent view of the impact of information systems. The environment in which a firm operates or the way in which it is structured were taken to be factors that modified the relationship between outcomes and the use of technology. Thus, firms operating in uncertain environments were considered to be more appropriate candidates for the use of computer systems (presumably because the potentially greater access to information they provided could be used to reduce work related uncertainty) than firms operating in stable situations. Workers using systems that were appropriate to the work being performed were expected to have more positive reactions. While this line of thought was useful in comparing responses among industries it was of little assistance in explaining how the attitudes of any individual worker or group of workers were likely to change.

Some researchers have adopted a political perspective. Sometimes this is based on a broad ideology, such as Marxism, where workers are seen as being exploited and oppressed by management and society [Zuboff 82]. Computer systems are, thus, devices to be used for manipulating workers. In these studies, the focus of attention is the mechanisms embedded in systems that can be used to control the behavior of workers. Other researchers have adopted a more pragmatic view. For example, Keen [Keen 81] observes that the "social inertia" of work settings is one of the causes of natural resistance to change exhibited by most people. Markus [Markus 83] has suggested that resistance to a system can be explained by shifts in the balance of power among actors.

Another line of inquiry, closely related to that of the political analysts, involves social interactions among workers. In this view, organizational culture and expected patterns of worker behavior influences the way individuals interpret the symbols (events) in their environment [Salancik 78, Kling 84]. Thus, the opinions of one's peers largely determined one's own reaction to events. If the prevailing culture believes a system will be beneficial, workers are likely then to respond favorably.

Another focus of research has been the process by which a system is implemented. Introducing a computer based system into a work setting is considered bringing about planned change. This involves preparing people for the change by making them aware of the deficiencies of the old way of doing things (un freezing), introducing the change (changing), and finally training people in the new methods in order to build patterns of behavior (freezing). Two factors appear key: the extent to which top management is involved in the process and the involvement of the actual users of a system in its design [Bikson 81]. Top management needs to be part of the process to limit political maneuvering and to give proper signals to the staff. Involving users in design provides them with an opportunity mold the system more to their needs and thus, presumably, they will then be more willing to accept changes associated with a system.

In the early 1980's questions were raised about the potential health hazards Video Display Terminals (VDTs) presented in the work place. These concerns center around visio-ocular and musculo-skeletal stress, cataracts, and other health disorders reported by workers in a variety of industries who were using these devices. The major factors considered a potential cause include terminal characteristics (i.e., character size, viewing angles, whether a keyboard is detachable, etc.), radiation intensity, seating position, ambient lighting, and patterns of use. A number of studies have been conducted [Smith 81, Sauter 83] all indicating that VDTs, themselves, do *not* have significant health or quality of working life consequences for people using them [NAS 83, AAO 82].[4] It is important to note that the VDT *device* was the central focus of these studies. Little attention was paid to how a computer application system might be used to *alter* the content of a worker's job.

A final approach sees the tasks workers perform as moderating between the use of computer systems and various outcomes. From this perspective the decision to develop a computer application system results in a new man-machine division of labor with the worker performing a different set of tasks than before. It is in reacting to these tasks that the worker experiences changes in working life quality and in productivity. This model will be developed more fully in the next section.

In summary, a variety of prospectives have been used to investigate how workers react to the use of computer systems. While this problem was thought initially to be a relatively straight forward question, as shown in Table 1, the complexity is evident when one considers the number of variables that are

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[4]Given the negative findings of all research studies, it is ironic that a number of states in America have proposed legislation regulating the use of VDTs in the work place.

likely to influence outcomes. Each perspective sheds light on a different aspect of the situation.

| Technology | Task | Structure |
|---|---|---|
| kind | demand | formal |
| extent of use | autonomy | social support |
| processing org. | extent of sup | ease of assistance |
| complexity | content | |
| functions supt. | freq. & seq. | |
| ergonomics | procedures | |
| | org. of work | |
| | div. of labor | |
| | job level | |
| | control strat. | |
| | incentives | |
| **Individual** | **Organizational** | **Physical Env.** |
| Age | culture | noise |
| sex | norms | light |
| skill lev. | | air |
| prior exp. | | heat |
| values | | |
| family life | | |
| **Outcomes** | **Implementation** | **Other** |
| mental strain | actors | abstractness |
| health probs. | mgt. support | problems |
| satisfaction | power shifts | solutions |
| performance | | dependencies |

**Table 1:** Factors Influencing Worker's Reactions to Computer Use

**Task-Impact Model**

Considering the large number of factors that are likely to influence any specific situation, the best strategy to follow, when attempting to understand what the reactions to any specific situation will be, is to adopt a diagnostic approach. This involves establishing how a situation rates on a variety of factors and comparing these ratings to norms in an attempt to identify those factors that are problematic. In this regard, it is useful to have a model that relates a variety of potential factors to outcomes. One such model is the Task-Impact Model that relates changes in the task environment to characteristics and intensity of use of computer application systems [Turner 84, Turner 85].

Briefly, a decision to develop a computer application system implies changes in the content of tasks workers perform and in the structural arrangements among workers. That is, changes in the man-machine division of labor that occur during the design of an application system result in certain tasks being performed as programs by a computer, while others are performed by an operator. After completion of a transient implementation process a steady state condition emerges with the operator performing a new sequence of tasks, possibly some with new content. It is in responding to this new combination of tasks that the operator experiences changes in outcomes.

Workers are conceived as open social systems that must deal with both external and internal sources of work related uncertainty. That is, they must cope with the difference between the knowledge needed for task execution and what they know. This uncertainty emanates from two sources: lack of knowledge about how to perform a task, and lack of knowledge about what to do when exception conditions arise [Perrow 67]. Exception conditions occur primarily from variations in input (e.g., the state of raw materials) or by the operator encountering some unexpected event.

Five factors contribute to task related uncertainty: the nature of the task, the condition of inputs, the tools available to the worker for performing the task, the worker's experience and skill, and the structural arrangements among workers that govern information flow.

If workers are to deal with these sources of work related uncertainty, a critical factor is their ability to obtain and interpret (that is, process) information they do not possess [Galbraith 73]. Information can come from a number of sources including documentation, co-workers, and supervisors. A basic function of structure is, thus, to create work unit configurations, as well as the linkages among these units, that facilitate information flow.

The interplay among these variables is mediated by the extent to which sub-tasks are self-contained or interdependent. When one must seek assistance from others, the specific structural arrangements among workers for exchanging information, the social context of the work environment, and the norms developed from past experience all influence the worker's perception of how much effort (and time) need be expended to obtain problem solving assistance [Salancik 78]. This, in turn, influences the worker's performance.

Figure 1 shows the Task-Impact Model. Outcomes, such as job satisfaction, emotional exhaustion, and productivity are influenced by task and structural factors, such as, discretion, work load, problems, and interdependence. These factors, in turn, are affected by the characteristics and extent of application system use. That is, workers' attitudes and performance are a function of task characteristics and structural arrangements which are, in turn, a function of the characteristics and use of an application system.

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  independent          intervening          outcome

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| use and char.|     |    tasks     |     |    worker    |
|      of      | --> |     and      | --> |  attitudes   |
| application  |     |  structure   |     |     and      |
|   systems    |     |              |     | performance  |
 --------------       --------------       --------------
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**Figure 1:** Task-Impact Model of Application System Impacts

The new set of tasks an operator performs as a result of using a computer application system involve different sequences of operations and pose new sets of problems with which the operator must cope. They also result in new interdependences with co-workers and supervisors. This, in turn, creates a need for the acquisition of new skills which is usually accomplished through training, or by experience. It is in responding to this work environment that an operator experiences changes in job satisfaction or emotional exhaustion and by which performance is established.[5]

**The Dynamics of Computer Mediated Work**

Research based on the Task-Impact Model can be used to explain how workers are affected by computer mediated work. In a study of mortgage loan servicing workers in savings banks, Turner [Turner 85] demonstrated that changes in task factors were related to differences in intensity of computer application system use. No differences, however, were found in measures of well being, such as job satisfaction, absenteeism, or emotional exhaustion. He speculated that while the use of computer systems in this job altered the tasks workers performed, these changes were not sufficient to influence well being. Similar findings were reported by Sauter [Sauter 83] in his study of workers in a government agency.

How might changes in the content of tasks be related to outcomes? Four variables are useful in describing the dynamics of change. Task demand is a measure of the amount of work performed by an operator in accomplishing a job. Discretion

[5]Other factors, such as changes in performance reward relationships, supervisor style, social interactions, etc., are also likely to influence job satisfaction and emotional exhaustion.

indicates the degree of freedom an operator has in selecting work methods. Interdependence is a measure of the extent to which an operator relies on others in performing his job. And, assistance ease represents the degree of difficulty in communicating with other workers, and in obtaining problem solving assistance. This last factor, is, in essence, a measure of the effectiveness of the particular structural arrangement (organizational as well as physical) chosen for a work unit.

In general, increases in task demands are associated with moderate increases in interdependence among workers, moderate increases in mental strain symptoms and small decreases in job satisfaction. Increased discretion, on the other hand, is associated with small decreases in mental strain symptoms and moderate increases in job satisfaction. Thus, task demands and discretion can be thought of as complementary factors; demand operates principally as a stressor influencing strain symptoms, while discretion, by providing the operator flexibility, permits the operator to cope with the particular work problem, and thus, affects job satisfaction.

Interdependence is another form of stressor.[6] As the work load builds up, exception conditions are encountered that require resolution. Consequently, workers must seek assistance from

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[6]This formulation differs from the way interdependence is usually treated in the literature where it tends to be viewed positively, because it implies an increase in social support. In this case, however, interdependence has negative overtones because interactions require workers to interrupt their job in order to solve another's problem.

others in the work unit for problem solving aid. When this assistance is hard to obtain, workers experience an increase in the difficulty (demand) of accomplishing a task, since they are prevented from completing their work. Making assistance easier to obtain reduces strain and increases job satisfaction by removing a barrier to work related communication.

The use of a computer application system enters the picture by influencing demand. Because systems, especially for routine clerical jobs, often involve machine pacing, repetitive tasks with little variation performed in short cycles, and tightly prescribed procedures (for example, data entry clerks or information operators), the operator faces a heavy work load. The pace of the work combined with exception conditions that the operator is not prepared to handle result in a job with high demand.

Although not included specifically in the Task-Impact Model, two other factors are helpful in interpreting outcomes. Computer mediated work is often designed with relatively little variety in the content of tasks performed. This results in a job becoming repetitious and boring. While there is little evidence that jobs actually become more repetitious (in fact, the data suggest just the opposite, that workers perceive their jobs as requiring greater skill [Olson 85a]), de-skilling of work as a result of computerization has been a major concern and remains a possibility.

A second issue is the extent to which a system is used to control worker behavior. Because computer application systems capture so much information about workers, it is possible to monitor activities closely and attribute mistakes to individual workers. Thus, any worker's activities can be closely tracked. Again, while there is little evidence that systems are used more for this purpose than previously, the *potential* to do so remains.

A third factor that separates computer mediated work from other forms is its abstract nature [Zuboff 82]. While it is true that operators must conceptualize a document in a form, using a computer application system, different than when using an original document[7], it is not necessarily clear that this is more cognitively demanding. Staring at a blank piece of paper is pretty imposing!

Finally, computer mediated work permits greater connectivity among workers, with the potential for relaxing constraints on when and where work is performed [Olson 85b]. Electronic mail is a good example. It can be used to supplement other forms of communication, for example, in broadcasting messages to groups of employees with a common interest and as a substitute for more traditional forms of coordination.

Any specific outcomes are mediated by several factors. Reactions to a work setting are conditioned by expectations. A worker's previous job and prior experience are major contributors

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[7]For example, most text editors permit the operator to view a twenty four line "window" into the document. One frequent mistake that novice operators make when "moving" text of greater than twenty four lines is to append two copies of the text at the location to which the text is being moved.

to their expectations, as are the social setting and culture of the job. Thus, workers tend to see their current job in relation to their previous one, as moderated by the norms and values of their work group.

Another mediating factor is the worker's skill level. When this exceeds the skill requirements of the job, a worker is likely to desire a challenge in the job. Under these circumstances, learning new skills and having an opportunity to control work methods (that is, having discretion), is likely to be important. When, however, the worker's skill level is below that required to perform the job, a tightly prescribed routine may be preferred until the new skills are acquired.

Outcomes are also different for different job levels. For routine clerical jobs, where the work regime is tightly prescribed and operators have little choice as to whether or not to use a system, effects of computer use are intensified. In situations where use of a system are optional (usually higher level jobs where the work is non-routine), those people who are not inclined to use a system, do not, and consequently, overall effects will tend to be positive.

In summary, a variety of factors can be used to describe the changes that may take place when work is redesigned to accommodate computer systems. The demand of a job influences the degree of strain an operator perceives. Discretion, permits an operator to adjust to the needs of a job, thus reducing strain. Interdependence increases the demands of a job, while providing problem solving assistance partially compensates for increased demand. Several factors, including prior experience, level of the job, and operator skill level moderate these relationships.

**Reasons for Outcomes**

One might well ask, "why is it that when a job is redesigned for a computer system it tends to become poorer?"[8] The reasons have to do with who controls decisions during design and implementation of the system. Although user involvement and top management support are the most frequently given prescriptions for successful implementation, these involvements are often superficial. Real control of key decisions rests mostly with the information systems staff. Technical specialists, if left alone, tend to be guided by objectives of machine efficiency or technical elegance. Part of the reason for this has to do with their reward structure, which is often based on developing an efficient system independent of any other consequences. Part of it has to do with technical specialists' preference for deterministic problems and a dislike for the ambiguity and uncertainty involved in dealing with people (this, to a certain extent, is an issue of self selection). Part also has to do with the technical specialist's lack of exposure to principles of work design. Most application system designers, in the United States, have neither formal training in job design or first hand experience in line operations. Consequently, job design issues tend to be neglected.

Often, too, changes in work roles and structure that occur

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[8]Most of the research for routine clerical jobs indicates a slight negative effect.

with application systems are not planned. They are just the result of the design of the *machine* portion of a system. Technical specialists focus inwards on the detailed logic of their programs, often neglecting the consequences that larger decisions (e.g., the division of labor between operator and machine, the boundary of the system, and its complexity) have for the ultimate users of the system.

Third, in this country, management often maintains an adversarial view of workers. Productivity issues have much higher priority than quality of working life. There are few vehicles for mutual problem solving and workers do not have formal role to play in the implementation of a system as they do, for example, in several european countries. Thus, it is not surprising that when trade-offs need to be made, they tend to be made at the expense of the worker. If management's conception of workers is that they will take advantage of them given the opportunity (as evidenced by making them, for example, account for every telephone call made, every office supply used, and declare their exact whereabouts) then they are not going to grant workers the type of freedom necessary to take advantage of information technology.

The implementation of a computer application system should not be considered an exercise solely for technical specialists. Involved are key strategy and policy issues that effect the whole organization. For management not to be actively involved is a shirking of their responsibility to provide overall leadership.

**Strategies for Recovery**

Broadly speaking, there are three class of strategies available to management. The situation may be *prevented* by an intervention during the planning and implementation stage of a new application system. Second, once a system with negative consequences is realized, compensating actions can be initiated. Third, individuals, faced with a poorer job than previously, can engage in some form of coping behavior.

Prevention strategies begin with an assessment of the current work situation along the dimensions of importance (e.g., demand, discretion, interdependence, and assistance ease) to identify those that are problematic.[9] This provides a baseline for future action.

There are five categories of actors that can engage in prevention behavior: executive management, user management, technical management, individual implementors, and individual users. Executive management sets the context and tone in which trade-off will be made. If the culture of the organization respects the dignity of workers, then the design of a system can be used *both* to improve productivity and working life quality. If, however, the organizational philosophy is exploitative, then outcomes are pretty much pre-determined.

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[9]It is easy to include a variety of other factors that are likely to influence outcomes, such as supervisor relations, task variety, performance reward relationship, conflict and ambiguity, etc. to obtain a more complete picture of the work setting.

The last four categories of players form the implementation team. It is they that make the key decisions during the building of a new system. One of the most important issues is the way design decisions are made. If these are controlled by the technical staff, then the system will have a distinct technical bias. Opportunities to redesign work will tend not to be followed. If, however, decisions are shared then a wider range of factors will be considered during design.

Unfortunately, it is the nature of routine clerical jobs, especially those consisting of repetitive, short duration tasks, to be demanding. The work load is heavy and the pace unrelenting. Boredom is a major problem. This suggests that every opportunity should be taken to involve the operator more in the job. If the operator's motivation can be increased, performance is likely to improve.

Several approaches are suggested by the Task-Impact Model. Creating jobs with decision latitude (operator discretion) can mitigate some of the undesirable effects of increased work load and pressure. This is because when people have an opportunity to select their work strategies and methods they can exhibit goal directed behavior. Giving workers some control over work processes permits them flexibility in responding to problem situations.[10] In this way workers are able to learn new methods and are constructively challenged, rather than becoming

[10] In more complex work situations a major parameter of effectiveness is the operator's freedom in selecting a response strategy [Sperandio 71].

demoralized, by their work setting.

Another strategy is to provide workers with unit configurations and procedures that encourage providing problem solving assistance. When a worker is under deadline pressure to produce and a problem arises, lack of easily obtainable assistance leads to frustration. The current level of technology does not permit building of effective assistance providing mechanisms within a system.[11]

User involvement is important in providing insights needed to re-think the organization of work and to broaden the issues considered during design. This is only effective when management provides sufficient additional resources so that users can allocate time to the process. And, users must be trained to perform this role. Overcoming the barrier of technical jargon and the need to shift prospectives from daily operations to that of testing alternative possibilities are key to meaningful involvement.

Compensating strategies that are initiated after a system is

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[11]The way assistance is provided in most application systems is by a "help" facility. Unfortunately, these require considerable knowledge about the system, e.g., keywords, in order to be used. The types of errors that are encountered are "diagnostic" where the operator wants to know why something occurred or how to handle a particular situation. The knowledge needed to answer these questions is outside the domain covered by current help systems. This is one of the areas where "expert systems" technology may useful, due to the "classification" nature of the diagnoses problem and the synthetic nature of the system.

implemented are more problematic. The new system may have alienated a component of the work force, undermining the credibility of management. The implementors may be committed to the new system, and thus, will resist new efforts to change it. The opportunities for action are much fewer at this stage than during initial design.

Coping strategies on the part of individual workers are even more difficult. It may be possible to customize some portion of the user interface. Most systems that support routine clerical tasks, however, permit little or no customization. A system may give a worker an opportunity to learn new skills. This can often offset the boredom that comes from a routine job, or the frustration from being prevented accomplishing a task.

**Conclusion**

Designing new human-machine systems is complicated. Specific strategies depend on the particulars of the situation. Management play a key role by establishing the context in which the design effort will take place. The first step is to assess the current work environment. Then, the *best* job for the worker is designed and the system configured to support the worker and the job. Finally, the worker is selected and/or trained for the new job.

Change is unavoidable with Information Technology. If this situation is viewed as an opportunity to re-think the organization of work, improvements in both productivity and working life quality are achievable.

## References

[AAO 82] Academy staff. *Video display terminals and the eye.* Technical Report, American Academy of Ophthalmology, San Francisco, CA, 1982.

[Bikson 81] T. K. Bikson, B. A. Gutek and D. A. Mankin. *Implementation of information technology in office settings: Review of the relevant literature.* Research Report R-3104-NSF, The Rand Corporation, Santa Monica, CA, 1981.

[Galbraith 73] J. Galbraith. *Designing Complex Organizations.* Addison-Wesley, Reading, MA, 1973.

[Keen 81] P. G. W. Keen. Information systems and organizational change. *Comm. of the ACM* 24(1):24-32, 1981.

[Kling 84] R. Kling and S. Iacono. The control of information systems after implementation. *Comm. of the ACM* 27(12):1218-1226, 1984.

[Mann 60] F. C. Mann and L. K. Williams. Obversations on the dynamics of a change to electronic data processing equipment. *Administrative Science Quarterly* 5:217-276, 1960.

[Markus 83] M. L. Markus. Power, politics and MIS implementation. *Comm. of the ACM* 26(6):430-443, 1983.

[NAS 83] NAS staff. *Video displays, work, and vison.* Technical Report, National Academy of Sciences, Washington, D. C., 1983.

[Olson 85a] M. H. Olson and J. A. Turner. *Rethinking office automation.* Technical Report CRIS 104, GBA 85-74, New York University, Center for Research in Information Systems, New York, NY, 1985.

[Olson 85b] M. H. Olson. *Impact of information technology on work organization: A positive view.* Research Report GBA#85-92, New York University, Center for Research in Information Systems, New York, NY, 1985.

[Perrow 67] C. Perrow. A framework for comparative analysis of organizations. *American Sociological Review* 32(2):194-208, 1967.

[Salancik 78] G. R. Salancik and J. Pfeffer. A social information processing approach to job attitudes and task design. *Administrative Science Quarterly* 23(2):224-253, 1978.

[Sauter 83] S. L. Sauter, M. Gotlieb, K. Jones, V. Dodson and K. Rohrer. Job and health implications of VDT use: Initial results of the Wisconsin-NIOSH study. *Comm. of the ACM* (4):284-294, 1983.

[Shepard 71] J. Shepard. *Automation and Alienation: A Study of Office and Factory Workers.* MIT Press, Cambridge, MA, 1971.

[Simon 81] H. A. Simon. Prometheus or pandora: The influence of automation on society. *IEEE Computer* 18(11):69-74, 1981.

[Smith 81] M. J. Smith, B. Cohen, L. Stammerjohn and A. Happ. An investigation of health complaints and job stress in video display operations. *Human Factors* 23(4):387-400, 1981.

[Sperandio 71] J. Sperandio. Variation of operator's strategies and regulating effects on workload. *Ergonomics* 14:571-577, 1971.

[Turner 84] J. A. Turner. *Computer mediater work: A comparative study of mortgage loan servicing clerks and financial investment officers in savings banks.* Research Report GBA #84-70, New York University, Center for Research in Information Systems, 1984.

[Turner 85] J. A. Turner. *Computer mediated work: A comparative study of structured and semi-structured jobs in savings banks.* Research Report, New York University, Center for Research in Information Systems, 1985.

[Weizenbaum 83]
J. Weizenbaum. The computer in your future. *New York Review of Books* Oct 27, 1983.

[Wiener 54] N. Wiener. *The Human Use of Human Beings.* Avon, New York, NY, 1954.

[Zuboff 82] S. Zuboff. New worlds of computer-mediated work. *Harvard Business Review* (Sept.-Oct.):142-152, 1982.