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THE IMPACT OF COMPUTER TECHNOLOGY ON CLERKS' WORKING LIFE:
IMPLICATIONS FOR STAFF TRAINING AND DEVELOPMENT

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
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*****

The Ohio State University
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Chapter I
INTRODUCTION

During the 1970's, organizations began the journey into application of high technology, particularly computer technology, in white-collar office environments. This passage includes: automation of routine tasks; switching paper work systems to computers; mechanization of manual tasks; and analysis, design, and implementation of systems to move us into the information age. Application of computer technology has had and will continue to have significant direct and indirect effects on American workers, work groups, organizations, and society.

The setting of white-collar work that will experience profound changes due to the impact of technology is the office. While all offices are different, they share certain similarities:

1. The work is highly labor intensive. Most of the operating costs go for salaries.
2. There is a lot of paper and paper processing.
3. Most use little technology, with typewriters or calculators being the most "advanced" tools (Toffler, 1980).
4. To move paper through the proper channels to the right people, there is a heavy reliance on procedures and human networks (both formal and informal).

5. There is a constant reliance upon and need for information, in a variety of forms.

6. There often is a tone of being "swamped"—too much work to do and too few people to do it.

In larger offices (over twenty people located in the same building), you might also see the following characteristics:

7. The office operates as a bureaucracy, with an emphasis on hierarchical lines of reporting and approval.

8. Most workers are in the clerical and secretarial functions, with a large percentage of those workers being female.

9. There is job classification, in the civil service tradition (emphasis on seniority rather than merit). Some clerks may belong to unions.

10. The work is frequently fragmented—one person performs tasks for only part of a process.

11. The job structure is fairly rigid; there may be some opportunity for horizontal job enlargement but little for vertical job enrichment.

12. The lower level workers (i.e., professionals, secretaries, and clerks) are relatively powerless within the organization. (Kanter, 1977)

The office is a web of people-paper and people-people relationships. This complexity of the white-collar world has been experienced by anyone who has tried to straighten out a bill or find the answer to a seemingly simple question, only to be met by endless referrals and run-arounds.
To many, computer systems in a variety of forms hold the key to making the office less convoluted, more streamlined, and more efficient. Advertisements for word processors and personal computers abound in popular and trade magazines. We are accustomed to bills generated by computers. In the near future, small and large computer systems will converge and diverge until they permeate every aspect of white-collar working life. By 1990, most office workers will spend part of their day with a computer.

Computers are invading the workplace in increasing numbers. The degree to which employees enthusiastically incorporate these new machines into their work varies widely. In some cases, the new computer, word processor, or terminal sits in a corner gathering dust. In other instances, people vie for the time to use the new, challenging, time-saving device.

The factors that contribute to successful integration of a computer into one's work and working life are many and complex. Some of the most basic and important are determined before the computer system arrives: the appropriateness of the system for the initially designated tasks; the system's ease of use or friendliness; and the reliability of the system. Even a system scoring high in these analysis and design areas can fail, cause chaos, or quietly fade into disuse if it is not properly introduced to the people
in the office environment. A proper introduction might include adequate training, a feeling on the part of the workers that they understand and, in some sense "own" the system, and a sense that they, in some way, can control the computer rather than vice versa.

Computer systems in offices are innovations, and as such pass through various stages of initiation, expansion, and integration (Lieberman, Selig & Walsh, 1982). The ideal case might be described as follows. After thorough analysis and design, a computerized accounting system is installed in office X. The managers realize the importance of prior training, and before the office workers have to do any real work on the system, the managers ensure that the workers receive some training and are able to practice a few trial runs. The workers, in general, look forward to the new system and use it as they have been taught.

A long-term and more profound aspect of implementation, however, particularly for successful systems, is mutual adaptation (McLaughlin, 1976) or integration (Lieberman, 1982)—the computer system's changing to the needs, strengths, and limitations of the workers and organization, and the workers' and organization's changing to meet the needs, strengths, and limitations of the computer system. During adaptation phases, on the people side, you might see redesign of jobs, work groups, and sometimes the entire
organization. From the computer system side, there may be redesign of reports or the forms displayed on the video screens. A mutual adaptation between office and computer probably is the major factor in the eventual or long-term success of the computer in the office.

Much has been written and said about making computer systems adapt to human needs: the structured programming methodology movement of the 1970s is meant to build change and flexibility into a computer system. "User friendliness" is the marketing cry of a "good system." Yet relatively little effort has been put into examining the changes office workers must go through in adapting to the computer system. When done, studies in mutual adaptation often have focused on small elements of the computer-worker relationship: use of screens and keyboards or color of screen displays. Or, at the other end, authors have predicted long range impacts on life and society such as the "information age," the "paperless society" by the year 2000, or the "home as workplace." Little study has been done of the relationship between the worker and the computer from a broader holistic viewpoint. Few have focused on what might happen between now and 1993.

Underlying an understanding of the human side of adaptation is a need for further examining the types of changes taking place. Do changes occur in a gradual, evolutionary
manner (small modifications daily or weekly) or are there profound shifts in the way work is done (two months after installation, most managers are typing their own reports)? What impact do these changes have on the working life of employees? Is job redesign necessary? Are there changes in informal and formal organizational structure? Do relationships between people, within their own work groups and between work groups change?

If we have a better understanding of the impact of computer technology on work, it may be possible for organizations to anticipate, plan for, and direct that impact. Such direction might be implemented through job redesign, organizational restructuring, systems design, and, finally, education and training. While areas such as job redesign, changes in organizational structure, and participative systems design certainly affect the change process, training and particularly a broader educational approach may hold the greatest promise for organizations as they develop through the end of the century.

1.1 STATEMENT OF THE PROBLEM

The 1980's will be a decade of dramatic change in office work, affecting the working life of over half the work force. The major factor in this change will be the introduction of computer technology into the office. The
purpose of this study was to describe the impact of computer system installation on the working life of office clerks. Based on those described changes, the researcher proposes education and training programs to direct and ease that impact.

A greater understanding of the change process may help organizations similar to those studied design and implement effective training and education programs that would guide the adaptation between computers and office workers. In addition, findings may have implications for: the design of the computer system; job redesign; changes in work group composition and processes; changes in organizational structure; and shifts in career development.

1.1.1 Focus of the Study
Within this large realm, the most particular focus was on individual working life, with an emphasis placed upon clerical workers. There were several reasons for selecting this point of focus. "Working life" provided a holistic approach for examination and description of the worker in his or her environment. Some dimensions of working life include: job content, peer relationships, employee-supervisor relationships, inter-group relationships, and career development.
There were two reasons for focusing on clerical workers. First, clerical workers and secretaries are the largest percentage of white collar workers. Second, clerical workers typically have the most frequent contact with the computer system, and probably experience the most change in daily tasks.

Individual clerks were the focus of the study, but the data collection and analysis were not limited to their tasks or viewpoints. Other aspects of the office—management, physical setting, organizational climate, work groups, organizational structure, the computer system—emerged within the research frame and became part of the data collected and analyzed.

1.2 RESEARCH QUESTIONS

The study had a dual purpose: 1) to describe the impact on clerks' working life when a computer system was installed, and 2) based on those changes, to discuss staff development and training programs that would ease that impact.

The question guiding the majority of the data collection concerned the impact of the computer system.

| What was the impact of computer system installation on clerks' working life? |

The more specific questions included the following.
1. Were there changes in duties that a person was expected to perform?
2. Were there changes in responsibility for one's work?
3. Were there changes in relationships between peers?
4. Were there changes in relationships between clerks, immediate supervisors, and higher-level managers?
5. What was the general attitude of people towards the computer system? Had it made life better or worse?
6. Were there changes in work groups?
7. Were there changes in inter-group communication and relationships?
8. Were there changes in organizational structure?

In examining these changes, it was realized by the researcher and the informants that the computer system was only one impacting element in the change process. Thus, some effort was made to search for and describe other factors in the setting that may have contributed to the changes described by the informants. A final recurring question was:

9. Were the changes caused by the computer system installation or did the computer merely act as a catalyst?

The second research question, emphasized more in the analysis and interpretation phase, concerned staff development and training.
What training and education programs could an organization use to ease and guide the adaptation process between the clerical staff and the computer system?

Some more specific questions included:

1. What types of training are appropriate at what times?

2. What types of education are appropriate at what times?

3. What dimensions of the change and adaptation process might be addressed through education and training? What changes lie beyond the scope of training and education?

1.3 RESEARCH DESIGN

The design for research was a comparative case study. The settings were selected because of their marked similarities and differences at the outset of the study.

The similarities (public sector, size, function, and computer installation date) were strong enough to provide a foundation for comparison. Yet dissimilarities (different computer systems, success of initial transition, and attitudes toward the system) were marked enough to provide possible keys to several issues. Through those dissimilarities, could you find the keys to successful initial implementation (one was successful, one was not)? Another point of interest concerned potential similarities between
the settings. In spite of differences, were were the offices going through similar change processes and experiencing similar effects? The settings intentionally were examined more than one year after the computer systems were installed. The delayed examination was chosen in an effort to describe long-term effects rather than immediate change trauma. While it is important to have an understanding of short-term impact and how to deal with it, it is the long-term effects that have been least explored and probably are the most important for organizational planners and educators (Olson & Lucas, 1982).

1.3.1 Evolution of the Design

Research grows from experience as well as being of experience. In naturalistic inquiry, designs evolve within the scope of the study, but they also evolve before the official research begins. Following is a personal description of how this research study began.

In October and November 1981, as part of a course in ethnographic methodology, I examined the implementation effects of a computerized information system in the Office of Admissions at The Ohio State University. I began the study believing that I would see symptoms of change trauma such as powerlessness over the change, rejection of the system, dissatisfaction with new work and roles. Instead, in the
setting, at that time, the transition and adaptation process had been remarkably smooth. The smooth change process was attributed to participative design of the computer system, planning, job redesign, organizational restructuring, and education and training. In the midst of this paradise, however, was a tone of being in the eye of the storm. The heaviest paper processing period was about to begin, and no one was sure what was going to happen. They knew they were not "out of the conversion woods yet." People interviewed, particularly managers, said, "come back and talk to us in a year."

In December 1981, I received a delinquent notice for my quarterly water bill from the City of Columbus, Ohio. I was sure I had paid the bill, so I called the Division of Water to straighten things out. After listening to a "our lines are busy" recording, and waiting for five or ten minutes, my call was finally answered. Here is a paraphrase of that conversation:

Customer: I received a delinquent notice for a bill that I think I've paid.

Clerk: If you've sent in your payment, please ignore the bill. We put in a new computer system recently, and the computer made an error.

Customer: OK. Thanks.

Having worked around computers for several years, I interpreted this conversation in several ways. First, computers
rarely make mistakes—it's the people who tell the computers what to do (the programmers) who make the mistakes. Second, computers are very good at doing the same thing over and over again; my educated guess was that not only me but thousands of other people had also received erroneous delinquent notices. Several questions immediately arose. Why didn't someone notice the large increase in the number of bills being produced? If someone did notice, why didn't he or she say something? Was it always assumed that the computer system was right? Were the clerks relinquishing responsibility (perhaps rebelliously) for the accuracy of the work? As far as the clerks answering all those phone calls were concerned, how were they coping psychologically with all those inquiries and probable complaints?

Juxtaposed to my recent experience with the success story of the Admissions Office, the Division of Water seemed to suggest a dichotomous experience of computer system installation. I was intrigued.

That is how this comparative case study of the effects of computer technology of clerks' working life (one year or more after system installation) began.
1.4 **Methodology**

Data collection methods included: intensive open-ended interviews; brief conversational interviews; observation; and examination of documents and records. As a closure and synthesis mechanism, some interviewees were asked to graph their reaction to the system and their jobs over a two-year pre- and post-installation period. Initial analysis of the intensive interviews was done using a computer-based text editor to search for recurring word and phrase patterns within the text. In addition, simple word counts were performed in an effort to identify frequently occurring or unique words. Detailed analysis was done via Glaser's (1976) constant-comparative method of category construction. The constant-comparative analysis was supported with computer-based text-editing, text-formatting, and indexing systems.

1.5 **Summary of Findings**

Both offices experienced similar change trauma during the first year. There was an overwhelming volume of work, accomplished only through heavy use of overtime in the evenings and on weekends. Physical and psychological stress were frequent. Approximately nine months after system installation, the work load began to diminish.

In the office that had included high levels of management and staff participation in the system's design, had
worked with a reliable system, had redesigned jobs and work groups, and had conducted a thorough training program, 15 months after installation, there were generally strong feelings of system acceptance. In the office that had hired a consulting firm to design and implement the system, had not worked with a reliable system, had not trained their staff adequately, and had not redesigned jobs and work groups to a great extent, negative attitudes towards the system persisted 15 months after installation.

In spite of marked differences, several patterns of change in work were evident and emerging in both settings: increased task diversity; evolutionary job enlargement and enrichment; increasing similarity between jobs; decreased inter-group contact; and altered supervisory and management roles. The predominant pattern was one of decreased physical radius but an increased mental radius in a clerk's job. This may result at a very general level from: 1) the disappearance of paper systems which enforce fragmented, linear processing; and 2) universal access to immediately available, nearly total information via the computer system.

Finally, informants constantly stated that the computer system had acted as a catalyst for rather than a cause of change: changes in organizational structure would have happened anyway, or the computer aggravated existing problems. These perceptions may be the keys to understanding how
computer systems fit into working life as the most powerful communication tool we have ever had.

1.6 SUMMARY OF IMPLICATIONS FOR STAFF TRAINING AND DEVELOPMENT

The need for task-specific training before and during system installation was stated over and over again. The need for a larger, conceptual view of the system varied in its timing—some people wanted it before installation, some a few months after, some never.

The documentation available was rarely used. Without documentation, training is done through the passing on of verbal lore from peers and supervisors; this was the predominant training method in both settings. With increased task diversity and job enlargement, a lack of procedures, system documentation, and other training materials and support can result in misinformation, redundancy in training efforts, and many mistakes. While it probably is not possible or wise to write everything down, a little would help a lot.

An eventual organizational goal should be to promote more general computing education among their employees. Computer systems are here to stay, but it is likely that they will change dramatically every two to five years. As they change, so will jobs and organizations. A staff of clerical workers who are skilled computing generalists may
give an organization the flexibility and adaptability it needs to survive and succeed.
Chapter II
LITERATURE REVIEW

In reviewing the literature related to "the impact of computer technology on office clerks' working life," three patterns emerged. First, there was no tightly organized body of literature. A few directly related studies had been conducted (Mumford & Banks (1967) and J. Turner (1980) are prime examples), but a neatly defined body of literature did not present itself. Instead, research on and statements about the topic appeared in related literature areas such as computer systems design, the impact of computers on society, and office automation. Perhaps the greatest problem in examining articles, books, and proceedings of conferences was that there was little overlap in references and bibliographies, i.e., it was difficult to discern the leaders in research or predominant paradigms in the various domains. While there was some sense of communication and coherence among the European scholars (Bjorn-Andersen, Hedberg, Mumford, and Sachman),¹ articles written

¹ The proceedings of the First and Second IFIP (International Federation of Information Processing) Conferences on Human Choice and Computers attest to this.
by Americans rarely cite these authors.

This was not surprising in a field that is so new. However, it does mean presenting a wider scope when discussing literature related to the topic. Before delving into the literature, it will help to present a conceptual framework for this diverse group of writings.

2.1 A CONCEPTUAL FRAMEWORK

The social structures discussed fall into several categories:

- society,
- unions,
- organization,
- work groups (clerks, supervisors, managers), and
- individual clerks.

These categories can be viewed as different levels and presented as a series of concentric circles, with the individual clerk at the center (Figure 1).

The topic areas discussed in relationship to these levels vary, but fall into these major areas:

- work,
- technology,
- communications,
- values, and
- development.
These major content areas are like spokes on a wheel, but in a more fluid sense, because changes in one area may start changes in all the other areas (Figure 2). The areas other than technology--work, communication, values, and development--also serve to define the dimensions of working life.
Now, if we overlay the topic areas model on the social levels model, we have a conceptual map for examining the impact of technology on work and working life at various social levels (Figure 3). Of fundamental importance is understanding that many of the effects of technology are indirect. For example, technology impacts organizational
communication which in turn affects how a clerk's job is structured, which in turn influences that clerk's career development.

Figure 3: A Conceptual Map for the Literature
Finally, the conceptual map can be refined a little bit more by indicating some of the concepts, terms, concerns or issues that predominate or surface at the intersection of the topic areas and the various levels (Figure 4).

Figure 4: Points of Intersection
It is not my intent to examine, in detail, each of the topic areas or intersections. The purpose of the map is to demonstrate the interconnectedness of a complex body of literature regarding computer technology and working life. The literature review will focus on the two radii of technology and work, with other topic areas introduced as appropriate. The discussion will begin at the outermost level, society, and work in towards the impact of technology on individual clerks. The presentation of writings on the impact of technology will be followed by a review of the main approaches—job redesign, participative systems design, and education—that have been proposed to ease and direct that impact. The review concludes with a discussion of the more global themes of adaptation and system complexity that recur throughout the literature.

2.2 IMPACT OF TECHNOLOGY ON WORK

2.2.1 Society

There are many prophets in this domain, with Bell (1979) and Toffler (1970, 1980) perhaps leading the race for predicting the future. Much of their work is speculative rather than empirical. Toffler (1970), however, argued that such a future-orientation is necessary for planning in a society and world that are changing so rapidly.
At the societal level, authors frequently discussed impact in a more global context. The super-industrial society (Toffler, 1970), the post-industrial society (Bell, 1979), the computer revolution, the information age, and the third wave (Toffler, 1980) were all terms used to describe our time. The generally agreed upon characteristics of this era included:

- demise of paper and the printed word (Evans, 1979),
- decentralization of commercial and business life (Evans, 1979; Toffler, 1980),
- switch from a goods to a service economy (Bell, 1979; Toffler, 1970), and
- at least temporary mass unemployment.

Points of difference or unique views abounded:

- bureaucratization of organization structure (Bjorn-Anderson & Rasmussen, 1980),
- collapse of bureaucracy (Toffler, 1970),
- development of a computer elite (Briefs, 1980a),
- disappearance of some professions (Haug, 1974; Sullivan & Cornfield, 1979),
- de-standardization and customization (Toffler, 1980),
- increased individual isolation and alienation (Stevens, 1980), and
- abdication of self and individual choice (Stevens, 1980; Weizenbaum, 1976, 1980).
A predominant theme of the effect of computer technology on work was that, at least in the short-term, there will be less work, fewer jobs, and high rates, if not mass, unemployment (Archer, 1975; Birchall & Hammond, 1981; Bjorn-Anderson & Rasmussen, 1980 Briefs, 1980a; Cockcroft, 1980; Jonasson, 1980). In an eminently British manner, Fisher (1975) referred to unemployment caused by technology in that machines will "supersede the human being in certain areas of economic activity" (p. 197). Certainly, the fear of losing one's job creeps or leaps into the head of any person who hears about the introduction of computers into his or her work environment. While unemployment will follow closely on the heels of technology, technology's trail, in the long run, may mean new jobs and reduction in unemployment (Archer, 1975; Bjorn-Anderson & Rasmussen, 1980).

2.2.2 Unions

At the union level, job security was of primary interest. Docherty (1979) described the union efforts in Norway to thwart work displacement brought about by technology. Union members had to participate in the design of the computer system. It was the responsibility of the companies to find new jobs, including retraining if necessary, for displaced employees (Briefs, 1980b). Efforts were made in general computing education so that people could:
1) participate more fully in the design process, and 2) in the long-term, have a greater chance of adapting to different jobs. Cockcroft (1980) believed that the emphasis should be on employment rather than jobs because individual jobs will change so dramatically in the coming years.

2.2.3 Organizations

There seemed to be three main issues at the organizational level: centralization/decentralization; changes in organizational shape; and levelling of the bureaucracy.

Robey (1980) attempted to analyze the research related to organizational centralization and decentralization following the installation of information systems. He concluded that there did not seem to be a causal connection between the computer and a centralization or decentralization phenomenon. The centralization issue surfaces in many articles. Several authors (Bjorn-Anderson & Basmussen, 1980; Groholt, 1980; and Simon, 1979) argued that both centralization and decentralization occur, but there might be a mild tendency towards increased centralization because of increased interdependency. The centralizing of information, however, might be balanced by physical decentralization (Evans, 1979; Toffler, 1980).

Zuboff (1982) believed that the shape of organization will change from the traditional hierarchical pyramid to a
diamond due to the increased numbers of skilled workers and professionals within the organization. There will be far less need for huge numbers of unskilled or semiskilled workers at the bottom of the organizations. This has implications for hierarchical organization.

The dissolution or collapse of bureaucracy and hierarchical structures is a common theme. Taylor (1974) stated that we will move toward more formless organizations. Moch, Bartunek and Brass (1979) argued that the stress experienced in organizations using complex technologies could be reduced if there were more organic properties—less formalization and more horizontal contacts—in the organization.

Jantsch (1972) saw us moving from stratified systems to multilayer systems to multiechelon systems—complex organizations with multiple horizontal and vertical lines of communication and distributed decision making. The role of those at the top was to coordinate and synthesize rather than delegate, control, and approve. The role of the smaller units in the organization was not to obey but to come up with their own ideas and ways of doing their work.

Toffler (1970) had a view akin to Jantsch's decentralized initiative and centralized synthesis. He argued that cumbersome bureaucracies will not be able to respond quickly enough. Organizations will have to become more kinetic,
constantly reorganizing to meet the existing situation. The assembling and re-assembling into "ad-hocracies" will be accompanied by changing shifts of power within the organization. As horizontal communication (what he terms side-stepping the hierarchy) occurs, the information base moves to the middle of the organization, with decision-making following in its wake:

> The cumulative result of such small changes is a massive shift from vertical to lateral communication systems. The intended result is speedier communication. This leveling process, however, represents a major blow to the once-sacred bureaucratic hierarchy, and it punches a jagged hole in the "brain and hand" analogy. For as the vertical chain of command is increasingly bypassed, we find "hands" beginning to make decisions, too. When the worker bypasses his foreman or supervisor and calls in a repair team, he makes a decision that in the past was reserved for higher-ups. (p. 139)

### 2.2.4 Work Groups

As information, initiative, and decision-making move towards the central levels, the composition of and roles within work groups are believed to change. Perhaps one of the most visible changes is in the role of managers and supervisors. With computer systems performing and managing the detailed work, a supervisor's need to oversee paper flow and check to make sure daily functions are being performed on time disappears. As people working for them have more responsibility, the supervisor's function of making
one hundred small decisions each day vanishes (Hepworth & Osbaldeston, 1979; Wilson, 1979).

Taylor (1974) stated that the new supervisor will function as a facilitator, boundary controller, and communications link. Birchall & Hammond (1981) noted this dramatic role change often makes supervisors feel the most threatened when technology is introduced. Managerial and supervisory control no longer are anchored by paper flow, lines of approval, physical boundaries, and personal issues (Zuboff, 1982). The increasing uncertainty and ambiguity of what one might do on a given day make systematic and rigid control obsolete. Instead, modes of managerial control switch to discretionary and finally developmental as the amount of uncertainty increases (Slocum & Sims, 1980). A supervisor no longer follows the flow of paper but the flow of ideas.

In The Office of the Future, Uhlig, Farber, and Bair (1980) stated that along with the changed roles and functions of a supervisor comes the ability to manage more people. Computer-based communication (e.g., electronic mail) enables the supervisor to "talk" to many employees at one time. Geographic boundaries are no longer important. He projected that the ideal size for a work group will change from 8-10 to 50-200.
The changing role of the supervisor means less supervisor-employee contact. Instead, employees begin to rely upon one another in learning, problem-solving, and decision-making situations (Hepworth & Osbaldeston, 1979).

2.2.5 **Individuals**

Hepworth and Osbaldeston (1979) described the impact of a computer system in an office. This description helps to build bridges between the impact on organizations, work groups, and individuals. The setting was a major public utility (electric) in Great Britain. She described what happened—not what was anticipated or planned—over two years. The evolutionary changes were as follows.

Fragmentation of both work and processing was eliminated. A clerk was responsible for every facet of a customer's account. The extension of the boundary of the clerk's job was accompanied by increased diversity. The clerk had more freedom in setting objectives, but also was more accountable for his or her work. If something was wrong with an account, there was no one else to blame. As more responsibility was placed in the hands and minds of the clerks, the need for direct supervision decreased. The hierarchical pipeline was bypassed as work went directly to clerks instead of through the supervisor. At one level higher in the organization, the middle managers were eliminated. The
overall pattern was a shifting of responsibility, problem-solving, and decision making to the clerks through an evolutionary process of job enlargement and enrichment. Hepworth's case study is unique in the literature because of its longitudinal, descriptive, evolutionary approach.

In his 1980 doctoral dissertation, Jon Turner provided an excellent review of eight research studies conducted in the 1960's and 1970's on the impact of computerization on clerks' work. He summarized the findings as follows.

- There is agreement in the results of the studies that:
  - jobs are more demanding—there is a greater work-load,
  - work is more anxiety provoking,
  - jobs are more formalized, and
  - employees are more productive.

- There is conflict in the results of the studies that there is:
  - more autonomy for workers higher skill levels.
  - increased interdependence among workers,
  - higher levels of job satisfaction,
  - increased specialization of work
  - increased task variety, and
  - higher level skills required.

The lack of agreement on the latter points is not surprising. Autonomy, interdependence, and job satisfaction are
complex constructs, usually heavily dependent (as Turner noted) on the organizational context.

Turner and several other authors (Bjorn-Anderson & Rasmussen, 1980; Briefs, 1980a; Galitz, 1980; Humford & Banks, 1967; Sullivan & Cornfield, 1979) concluded that automation has the potential for negatively impacting clerical work through fragmentation, formalization, specialization, de-personalization, and monotony. Turner noted that physical and psychological stress frequently resulted from high levels of human-computer interaction.

The negative aspects are balanced by changes that seem more positive: improved accuracy and efficiency (Meyer, 1982; Moran, 1982; Humford & Banks, 1967); increased use of skills and abilities (Moran, 1982; Humford & Banks, 1967); and more planning, responsibility, and judgment (Hepworth & Osbaldeston, 1979; Humford & Banks, 1967).

Rather than pursuing the negative/positive impact route, Zuboff (1982) attempted to provide a unifying concept for changes occur in "computer-mediated" work. Like others, while her perception was rooted in what she saw in the present, her orientation was toward the future. Zuboff saw abstract, conceptual thinking as becoming increasingly important in clerical work. There is a shift from direct experience to constructing and applying conceptual models. Zvoricyn (1974) similarly believed that there will be a new
combination or ratio of physical and mental labor, with mental skills becoming more and more important.

Hepworth and Osbaldeston (1979) noted that sometimes older employees have a difficult time adjusting to these changes. In some cases, other work must be found for them. In a similar vein, Bjorn-Andersen (1980) said that a new computer is like a selection mechanism—some can handle it, some cannot.

A final impact theme which surfaces occasionally is the shrinking human-to-human contact. Moran (1982) noted that automation results in decreased face-to-face interaction, particularly if people are not in close physical proximity to one another. Galitz (1980) also believed that there was less human-to-human communications. At a work group and organizational level, this new pattern of communication can result in altered social communities (Zuboff, 1982).

A good summary of how jobs are likely to change is provided by Strassmann (1982). In industrial culture, jobs typically are simple, standardized, and require common skills. Frequently workers perform isolated tasks within a very finite scope. Any options are predetermined, and there rarely is any change (jobs are immutable). There is little social interaction. He contrasts this portrait with jobs in the information culture. In this new culture, jobs will consist of a variety of tasks, and much of the
discretionary decisions will be left up to the worker. There will be higher levels of competence and more of a sense of closure and task completion in one's work. Rather than static, the work will be dynamic, with many changes, and many opportunities for learning. Finally, he predicted a change in the social nature of work, with support from co-workers becoming more important.

2.3 EASING AND DIRECTING THE IMPACT

To this point, the impact of computer technology on work at societal, union, organizational, work group, and individual levels has been reviewed. In almost every article or book that described the impact of technology, there also were suggestions of how to direct and ease that impact. These mechanisms or approaches to directing change fall into three major categories: job redesign; participative systems design; and education and training. A unifying theme among these approaches is a new view of and way to work.

2.3.1 Job Redesign

Most authors describing the impact of computer technology on work argued for mandatory job redesign accompanying the implementation of automated systems (Birchall & Hammond, 1981; Bjorn-Anderson & Rasmussen, 1980; Briefs, 1980a; Galitz, 1980; Guiliana, 1980; Greenbaum, 1979; Hofstede, 1979;
Jonasson, 1980; Humford & Banks, 1967; Olson & Lucas, 1982; Sullivan & Cornfield, 1979). Elements in conscious job redesign include:

- participation of employees in the job redesign (Birchhall & Hammond, 1981; Galitz, 1980),
- defragmentation of work (Briefs, 1980a; Greenbaum, 1979),
- centering of multiple if not all aspects of a process around an individual; sense of closure in one's work (Friedson, 1974; Galitz, 1980; Guiliana, 1982),
- increasing importance of values (Hofstede, 1979; Hedberg, 1980),
- emphasis on more effective, satisfying work rather than "labor saving" (Jonasson, 1980; Mumford, 1980),
- more decision latitude (Galitz, 1980; Turner, 1980),
- more control over what one does (Briefs, 1980a)
- recognition that there's more than one way to do a job (Galitz, 1980),
- emphasis on cooperative action rather than bureaucratic procedures (Greenbaum, 1979), and
- importance of clerks being able to identify with (individual) clients (Mumford & Banks, 1967).

The general trend advocated in job redesign was job enlargement and enrichment.
Several authors noted, however, that these principles go against the grain of bureaucratic, traditional management-science, and union concepts of jobs. Giuliana (1982) noted that fragmentation goes hand-in-hand with bureaucracies. Certainly the criteria cited above violate Weber's image (1974) of the ideal bureaucracy necessitating job specialization and hierarchical structure. Greenbaum (1979) stated that management science models applied to complex tasks require division, fragmentation, and specialization. Wilson (1979) described the conflicts that may arise when holistic job design meets these traditional views:

Where multi-skilled teams or work groups are an important component of a new form of work organization, these are often found to be at cross purposes with the "one man—one job" principle of many national systems of job categorization and wage differentials. (p. 7)

"Cross purposes" is a euphemism for the revolutions in work (Toffler, 1970, 1980) that will predominate in the remaining century. The changes that are likely to occur are profound ones that will take time. In redesigning jobs within a new paradigm, organizations are redesigned as well.

2.3.2 Participative System Design

The history of computer system design and implementation has been dotted with failures, many of which can be attributed to the lack of participation in the design and
implementation process by those who will be most affected by and have to use the system. The traditional model has been a computer system which is imposed upon people. London (1976) cited the major causes of implementation problems:

- machine orientation in development and design
- lack of user cooperation and involvement
- insufficient investigation
- lack of specific, quantified system objectives
- inadequate forward planning on the impact of the system on the individual (p. 46)

London and others (Docherty, 1980; Galitz, 1980; Groholm, 1980; Hedberg, 1975, 1978; Jonasson, 1980; Kaiser & Srinvasan, 1982; Kolf & Oppelland, 1980; Leminsky, 1975; Margulies & Colflesh, 1982; Humford, 1980; Shneiderman, 1980) argued that most of these problems could be lessened by involving the end users (the ones who use the system in the end) in the design of the system. The level of participation varies widely. The traditional systems analysis view (London, 1976) relies upon computer experts involving users in the design through interviews, structured walkthroughs, and design reviews. At the other end of the participation continuum are those who predict (and advocate) the gradual demise of computer experts as users learn to
design their own systems (Docherty, 1980; Groholt, 1980).

Other points on the continuum include users having final
approval of the design (Leminsky, 1975) and laws requiring
participation (Docherty, 1980).

Hedberg (1975, 1978) believed that when workers partici­
pate in the system design, along with a knowledge of system
function, they introduce issues and concerns related to
their own and the organization's power, reward, and value
structures and systems. Kolf and Oppelland (1980) pursued
a similar route, arguing that including users reminds de­
signers that: 1) designs are context-dependent and, 2) in­
dividuals are very important in the design. To Leminsky
(1975) this was part of increasing the social conscience of
programmers and designers.

Hedberg (1975) believed that in order for workers to
participate in the design, they must be able to trigger or
initiate a design, influence the outcome of a design, and,
finally, be motivated to participate. This is where educa­
tion and training enter the picture.

2.3.3 Education and Training

Picture Jane Smith. She has worked as a clerk in Company
XYZ for the past eight years. In high school she pursued a
business curriculum. She was introduced to typing, filing,
and general office procedures. Her tasks at Company XYZ
have changed occasionally during the past eight years, but her basic responsibility has been to organize receipts by account number and forward them to another clerk for posting. Company XYZ is going to automate their accounting system, and Jane Smith's job, at least in part, will be automated along with it. In fact, the tasks she has performed for years will no longer be necessary.

If we follow the previous arguments about people-oriented or centered approach to change, we would expect Jane Smith (or someone like her) to: 1) assist in the redesign of her job, in the context of the objectives of her work group, goals of the organization, a knowledge of appropriate job design criteria, and a basic understanding of what the computer system can and cannot do; 2) participate in the design of the computer system, bringing her own and her colleagues values into the design, and 3) anticipate eventual job enlargement and increasing responsibility and decision-making within the scope of her job. It is unlikely that Jane Smith, without some education and training, will be able to shoulder these new roles.

Hedberg (1975) described two roles that emerge when someone like Jane Smith is thrown into the design process. In the "hostage model," she attends meetings and answers questions. When she asks a question or challenges a decision that is about to be made, she is put in her place with
a deluge of technical jargon and adamant statements that "the computer can't do it." Without a knowledge of what computers can do, she is at the mercy of the computer specialists. A more subtle form of expert tyranny is the "indoctrination model." In this case, the specialists teach Jane, but teach her only their way of thinking. Her new training not only weds her to the desires of the systems analysts but separates her from her user family she is supposed to represent. She forgets their goals and values as she joins the computer elite.

In Europe particularly, there is a belief that without some general computing education, you cannot have meaningful participation in the system design and job redesign process (Briefs, 1980a; Docherty, 1980). A more general educational approach also was advocated in anticipation that jobs would continually change (Bjorn-Andersen, 1982; Briefs, 1980b; Cockcroft, 1980; Mankin, 1978). Zuboff (1982) followed the "employment not jobs" theme, believing in a diminishing identification with occupational roles and an increasing importance of transferable skills.

As far as job- or system-specific training in concerned, there was fairly clear consensus on the necessary training (Galitz, 1980; Katzan, 1982; Lieberman, Selig & Walsh, 1982; London, 1976; Uhlig, Farber, and Bair, 1980):

- brief system overview,
- basic functions course or training (related specifically to the person's work), and
- access, when needed, to training in intermediate and advanced techniques.

In addition to acquisition of task-specific skills and information, some authors advocated some more general education in the following areas, particularly for supervisors and managers:

- conceptual skills (Zuboff, 1982),
- creative problem solving (Zuboff, 1982),
- practice in abstract thinking (Turner, 1980),
- ways to manage change (Margulies & Colflesh, 1982), and
- inter-group and organizational communication (Wilson, 1979).

Implementation of training and education causes problems, particularly because much of the content must be provided when that individual is ready for it in a manner that relates specifically to a typically complex problem (Butler, 1982). Initial training and education may be handled best through group presentations and face-to-face interaction (Uhlig et. al., 1980), but the individualized instruction required later requires more flexible delivery systems with an underlying philosophy of guided user education and research (Briefs, 1980b). Possible instructional modes include:
• computer-based training (Uhlig et al., 1980),
• application documentation (Uhlig et al., 1980),
• a computer "counselor" whose sole responsibility is to provide personalized instruction as needed (Uhlig et al., 1980),
• on-the-job training (Katzan, 1982),
• advanced functions course (Katzan, 1982), and
• peer training and support (Hepworth & Osbaldeston, 1979).

The prior step to an organization implementing such programs is for that organization to realize and acknowledge the importance of computing education and training, and to make a commitment towards the development of its employees (Hall & Fukami, 1979).

2.4 DEALING WITH COMPLEX SYSTEMS

Throughout the literature on the impact of computer technology on work, there are two themes that occur at all levels of society and in all topic areas.

The first is adaptation: people adapt to computer systems; computer systems must adapt to people; people must learn to adapt to new jobs and new roles; and organizations must become more flexible if they are to survive. All of this adaptation takes time. There is an implicit and often explicit view that the more responsive, flexible, and
adaptive the process or system is, the greater is its chance of survival and success (Bjorn-Andersen, 1982; Hall & Loucks, 1977; Kim, 1980; McKenney & McFarlan, 1982; McLaughlin, 1976).

The second is an attempt to describe through a model these interacting, adaptive relationships between people's work and technology. One popular model has been the socio-technical systems model (Margulies & Colflesh, 1982; Taylor, 1978). There have been other attempts, however, to define complex whole systems (Ackoff, 1980) and move beyond the sociotechnical approach (Hedberg, 1978). Jantsch (1972) supported the movement towards a larger systems view and described a transdisciplinary approach to examining multiechelon systems. Uhlig et al. (1980) viewed organizations as complex communication systems, with individuals as the communications nodes. Peacock (1980) and Jantsch (1975) implied that in complex systems, the view of the world was centered in the self or the person viewing it or in a particular process. When the person or process changes, so does the model of the process and the relationships within it.

Bell (1979) viewed such attempts at model and theory building as one of the hallmarks of the post-industrial society. Through complex information and communication systems, there can be a centering and codification of theoretical knowledge. This is the new "intellectual technology."
While modern science, like almost all human activities, has moved toward a greater degree of specialization in its pursuit of more detailed knowledge, the more important and crucial outcome of its association with technology is the integration of diverse fields or observations into single conceptual and theoretical frameworks offering much greater explanatory power. (p. 165)

2.5 SUMMARY

Computer technology will have a profound impact on the nature and function of clerical work. While there is some debate about the negative and positive aspects of the impact, many authors believe that there will be gradual job enlargement and enrichment, with clerks assuming more diverse tasks, more responsibility, and more decision-making. This shift of responsibility downward in the organization may begin with or be caused by changes in work group and organizational structure that promote horizontal communication and result in flattening if not collapse of bureaucracies. Several authors see technology as assisting in the democratization of work.

The impact of computer technology on work can be eased and directed through job redesign, participative systems design, and education and training. The need for flexibility and adaptation is a persistent theme in the writings.

In examining the impact of technology on working life, there are attempts to model complex systems, which describe, perhaps rather than explain, the relationships
between individuals, social structures, and technology. This may indicate, as many feel, that we are on the brink of a new paradigm for describing our world and directing our inquiry into it.
Chapter III

METHODOLOGY

In Chapter II, a model was introduced for categorizing and examining some of the literature. Now this model will be used in a slightly different way to describe the methodological approach in this research project.

The model contains two structures, one overlaying the other. The social levels are a series of concentric circles; the topic areas are thick interconnected radii emanating from the center. Now imagine this diagram in colors, with each concentric circle and each radius painted a different color. While the paint is still thick and freshly applied, that circle is folded or shaped into a cone, with the colors on the inside. The individual (the innermost circle) is the tip of the cone. Now, think of the cone as a spinning top—twirl it around. As the cone spins around, the wet paint blends, colors fusing and intertwining until it's difficult to discern where one color ends and one begins. A snapshot of the inside of the cone in the midst of its turning gives you a brief glimpse of its inner surface.
The task of the researcher is to look at the inside of the cone, into the vortex, describe the composition of color at the moment, and sometimes explain what chemistry or particular movement caused that particular color combination. Some researchers (notably ethnographers) attempt to dive into the vortex and describe the view from within. It is the goal of naturalistic inquiry to view the vortex from within and without: 1) to attempt, through ethnographic methods, to describe one or more views of the world through the eyes of individuals, and 2) use those views of the inside to construct a description or theory which draws the view from the outside.

In describing and examining the interior of the cone, several problems occur. First, we have a still picture of a dynamic process, an instant in time. By looking at a static picture, we may have lost the most important clues to the blending of the colors. Second, in examining the inside of the cone, we may find it necessary to lay it flat by breaking it (thereby disconnecting threads of color) or stretch it out (thereby distorting shape, width, and length). Third, we are trying to determine the process by which and sequence in which all those colors combined. Usually, we don't even have an initial color chart to guide us. We see a brown splotch and try to figure out how it got there.
Within the paradigm of naturalistic inquiry (Guba & Lincoln, 1981), such an ambiguous and complex reality is assumed. It is the role of the researcher to describe the pattern of colors from within and without the vortex, and, if patterns are evident, propose plausible explanations of the relationships of colors and the processes by which they combined. At best, those descriptions and explanations can only be a distorted (sometimes a little, sometimes a lot), static view of a dynamic, complex process.

3.1 CASE STUDY APPROACH

The case study design was chosen for several reasons. First, it provided a holistic framework for a complex problem. In reporting results, it enabled detailed descriptions of the context of the study, important for others trying to determine the applicability of results to their own settings. Second, it assumed a grounded theory approach (Glaser & Strauss, 1967), important in any field that is new. No hypotheses or theories were proposed at the beginning of the study, although some emerged during the study. Third, as a reporting mechanism, the case study enabled divergent description while helping the reader to integrate those same descriptions (Guba & Lincoln, 1981).

The comparison of two settings provided for firmer development of hypotheses and theory, particularly in
discovering common patterns in the two settings or delineating factors and instances that were important but unique to a setting.

### 3.2 The Settings

The settings were two large offices (approximately 50 employees each) which installed a computerized customer or client information system in the last weeks of June 1981, fifteen months before the study began. Both systems were being used 15 months after installation with some degree of success. The two settings were the Office of Admissions at The Ohio State University and the City of Columbus, Ohio, Division of Water.

At the outset, the two settings had enough similarities and differences to hold the promise for comparison and contrast. Further investigation revealed that there was a sound basis for comparison. They were both part of complex bureaucracies in the public sector. They shared a climate of heavy customer contact, high pressure to get things done by deadlines, the feeling of being swamped with work, and the need to deal with situations that were personally critical to the customers. They were paper intensive. The workers were predominantly female, but the senior management was male. The workers were part of a civil service system which emphasized rigid work categories. The main
difference appeared to be the initial system installation. Of interest were what similarities and differences which occurred in encountered problems, changes, and adaptation.

3.3 **DATA COLLECTION**

Data was collected through: 1) interviews; 2) observations, with limited participation; and 3) review of documents and records. The primary data collection method was interviews during which people were asked to describe past and current events and feelings regarding the computer system and its impact on their work environment. Observations were used as a triangulating method for current data, while document and record examination was used as a triangulating method for retrospective or historical data. Data was collected in October, November, and December, 1982.

3.3.1 **Entry into the Settings**

Before data collection began, there was a meeting with the primary contact (a middle manager) in each setting. The purpose of the study, the general methodological approach, the time required, and the procedures to be used were outlined. Both managers indicated an interest and willingness for their immediate office to participate. The interview was followed by a letter to the senior managers in each setting which described the study.
Next, the proposed study was presented to a managers' or supervisors' group in each setting. Again, the purpose and general methodology were explained. Questions answered generally concerned time frames and procedures for scheduling interviews. At these meetings, an attempt was made to make it clear that the purpose was to find information, not to evaluate their systems, their work, or their management. These meetings were held during the first week of October 1982.

3.3.2 Interviews

The open-ended interview (Patton, 1980) was the primary interview technique. A set of questions, concerns, or issues was discussed, but the sequence and emphasis for the topics was determined by interviewee's interest and the general flow of the conversation. All topics were not necessarily discussed, thus these interviews were closer to open-ended than guided. Each interview took 45 minutes to one and one-half hours. They were: 1) conducted away from the person's immediate work setting to encourage easier and freer conversation; 2) audio recorded, with the consent and ease of the interviewee; and 3) scheduled in advance (with the supervisor's permission if necessary). There were 14 intensive interviews conducted in each setting. Unfortunately, the recorder was malfunctioning during the Division of Water interviews, and only 10 were recorded successfully.
The initial interviews were conducted primarily with the supervisors. The interviews then branched out to include the clerks. Both supervisors and clerks identified others they felt would provide useful information (Spradley, 1979). People did not hesitate recommending potential interviewees who had negative rather than positive views of the computer system or the office. Usually those persons whose names were mentioned two or more times were interviewed. Others were interviewed as time permitted and as the likelihood of obtaining significantly new information existed. (See Appendix A for a list of the titles of people interviewed.)

The intensive interviews were supplemented by conversational interviews, loosely or sharply focussed on-the-spot questions and answers. The short interviews were conducted in the immediate work setting, usually as a corollary to the researcher's observations. They were not audio recorded.

In the Admissions Office, there were 8-10 short interviews or conversations; in the Division of Water, there were about 25. While portions of these conversations concerned the computer system, a majority focused on general functions of their jobs and the office. Much of this type of background material had been gathered for Admissions during the previous year's study. The short interviews in
Admissions yielded little new information. In Water, the short interviews helped to establish the office background.

3.3.3 Observation

Each work setting was observed, with the researcher occasionally acting as a participant. (A more active participant role might have disrupted or proven detrimental to others' work; thus it was not pursued.) Observation was used as a triangulating method to: 1) fill in the blanks left by the interview; 2) confirm or invalidate themes, categories, and patterns emerging from the interviews; 3) uncover factors and patterns not found through interviews; and 4) provide a holistic view of the settings. The intent of observation was to collect data for describing the current state of the office. Points of focus during observation included: physical layout of office; physical movement within the office; decoration of work spaces; time spent at terminal; verbal and non-verbal behavior at the terminal; peer interaction; and worker-supervisor interaction. Approximately 40 hours were spent at the Division of Water and 10 hours at the Admissions Office observing. Again, less time was spend in the Admissions Office because of time spent there a year earlier. The observation was done on different days and at different times in an effort to account for regular or daily variations and routines.
Some note should be made here of the difficulty of observing clerical work. Even seemingly simple tasks like sorting the mail consist of a large amount of cognitive processing which cannot be observed. When tasks include using computers, much time (provided it is not clean-and-simple data entry work) is spent cognitively processing information displayed on a video screen—a phenomenon which can be observed only at a superficial level by a researcher. In some instances, detailed task analysis might be useful, but the aim of this study was a more general look at work and working life. Thus, observation for detailed task analysis was not used.

The majority of observation in the Division of Water was done in the Customer Services area where the clerks' main responsibility was to process customer phone calls. At each station there was an extra phone jack, and I was "plugged in" so I could listen to their conversations with the customers. This made the observation much more rewarding. I could follow their conversation, and watch how they used the terminal and system to answer questions. At a superficial level, one could follow their thought processes and see their interaction with the computer system.
3.3.4 **Documents and Records**

Interviews and observations were used to collect data to describe the current state of the office. Interviews, accompanied by an examination and analysis of documents and records, were used to discover and describe what happened immediately before, during, and after computer system installation. The purpose of document examination was to collect historical or retrospective data. Documents were used to: 1) fill in the blanks left by the interviews; 2) confirm or invalidate themes, categories, and patterns emerging from the interviews; 3) uncover factors and patterns not found through interviews; and 4) provide a holistic view of the settings.

Records examined included: monthly reports; error rates; weekly, monthly, or annual production reports; error or problem logs; and computer system problem or failure logs. Documents examined included: newsletters; special announcements; minutes of meetings; position descriptions; organizational charts; memos; employee surveys; and annual reports. (For a list of records and documents examined, see Appendix A.)
3.3.5 Data Collected

At the end of the data collection, the following data had been accumulated:

- audio tapes and transcripts of open-ended interviews,
- interview notes,
- observational notes,
- selected documents and records,
- notes on documents and records, and
- record of research events.

This was a large mass of textual data.

3.4 Data Analysis

There are several problems encountered in analyzing large amounts of textual data. First, the sheer volume is a problem; the interview transcripts alone in this study contain over 600,000 characters. Second, in a mass of data, it is difficult to locate the word, phrase, or passage you are looking for. Third, it is easy to lose the trees for the forest—the words are always seen in the context, and, perhaps more important, in your interpretation of the context. Fourth, since you're always looking at it as a clump, or mass, it is difficult to get a sense of frequency of occurrence of words and phases, sometimes an important key to meanings. Fifth, if you are following a categorization approach, sometimes a word or phrase belongs in more
than one category, particularly initially, making the "cut and paste on index cards" approach difficult.

I attempted to lessen some of these problems by using computer-based systems for portions of the data analysis. My intent was to: 1) make it easier to find words and phrases embedded in the text; 2) look at some of the words "out of context" as a second approach to the data; and 3) categorize more easily words and phrases, at least initially, in two or more categories.

Conceptually, this is not a new approach. Computerized text analysis systems have been used for the past ten or fifteen years. Most of those systems, however, like Stone's "General Inquirer" (1968), were non-interactive systems. The researcher punched data on cards, added some statements to control what data was to be analyzed and how it was to be analyzed, and then turned the job into the computer. Then he or she would wait a while, look at the printout, and try it again. There was relatively little flexibility, and, combined with the vagaries of the English language, the experience often proved to be frustrating.

My approach was not to have the computer analyze the data, but to use generally available computer systems to assist me in analyzing the data. When manual systems were easier, I used them, i.e., my analysis was supported by but not bound to the computer.
The intensive interviews were transcribed onto a large computer system using an interactive text editor. At this point, the transcripts were in "raw data" form (Figure 5). The first record or line in the file indicated the date, place of interview, and tape number. I then proceeded to transcribe, noting changes in the speaker by a period in the first position of the record, followed by a two-character code. There was one file for each interview.

```plaintext
 tagName: edit102182xxfb02
 Do you want to start with a detailed question or an overview one.
 An overview one; I'm a generalist.
 What's the general tone in the office right now?
 My view is kind of distorted because of the personnel changes that have been going on. The overall feeling in the office is bored—there's no work coming in. It probably has to do with the system but it's also due to the flow of the office. Last year it was always like that in October.
 It picks up again in November when you start the walk throughs.
 Yeah, and when people start getting their.

Figure 5: Raw Data
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Each file was then reformatted via a text editor and program so that each line in the file contained the ID or
tag information (date, setting, tape number, speaker) as well as the text (Figure 6). The separate files were then combined into two large files, one for each setting. At this point, many types of text analysis were possible.

Figure 6: Reformatted Data

As I had been transcribing, I jotted down words or short phrases that occurred frequently or seemed to identify concepts and possible categories of meaning. This served as my initial "key word" list. For example, I had written down the word "affect." Using the text editor, I could perform a global search of the large data file and list
all the lines containing the word or character string "af-fect." I would see not only lines containing the word "af-fect" but also "affected", "affection", etc. I could then look at those lines and decide whether or not I wanted to look further at the context in which those words were used. If so, I would list the lines before and after (Figure 7).

The ability to locate and examine words and phrases quickly made the process of looking at and poking around in the data much easier.

I was aware, however, that the keywords list constructed while transcribing embodied my biases toward the data. It was possible that I was missing important or significant (in meaning and in quantity) words. I attempted to provide the "other angle" I thought necessary by performing some simple word frequency counts.

This time I used the text editor to: 1) change all the letters to lower case, 2) eliminate filler words such as "and" and "the," and 3) eliminate word endings (e.g., "s ", "ing "). At this point, my file consisted of a rather cryptic series of root words or "trimmed text" (Figure 8). I then processed the file through a series of programs which: 1) generated a list of words spoken by informants, with each line containing the ID field and one word; and 2) sorted the list into alphabetical order.
The intent of this stage was **not** to perform detailed or sophisticated content analysis, but to see the words out of context. For example, it had seemed that people at the
Division of Water had had a lot of problems. When I looked at the word count list, the word "problem" occurred over 150 times, as frequently as the word "she." I also noted words such as "afraid" and "apprehension" that I hadn't written down as keywords but might be important but subtle indicators of meaning. Again, the purpose of these programs was to find initial keyholes through which to examine the data.

In addition to being able to enter a character string like "affect" and examine the lines at the terminal, the text editor could also list those lines on the high-speed
printers. Those lists could be used along with printouts of the transcripts to examine the data in a more detailed or leisurely manner.

The WYLBUR text editor used has sophisticated string search capabilities. For example, I could request that it find all the lines containing the string "affect" where I was not the person speaking (i.e., position 17-18 which contain the code for the speaker should not be "fb"). I could ask that it display all the lines containing the string "know" but not the string "you" (thus eliminating all the lines containing the phrase "you know"). You can build extremely complex search specifications, complete with AND, OR, and NOT Boolean phrases. The real power of the system, however, is that it is interactive. You can immediately restrict or expand search criteria depending on the results you are getting.

The intent of using these computing techniques was to provide a data-based categorization scheme for classifying the data. Glaser's constant-comparative method (1965) was used to generate, collapse, and expand categories.

Computer-based techniques were used, to some extent, to aid in category construction and maintenance. I wanted to keep the software as simple to use as possible, so I chose to use the indexing capabilities of the widely available SCRIPT text formatting program.
SCRIPT indexing is based on control words which are supplemental or added to the text. The index control words can be embedded in the text file or placed in a separate file. While this seems cumbersome at first, it gives the indexer a great deal of flexibility in how the word or idea behind the word is indexed; the word added to the index does not actually have to appear in the main text. For example, a person is talking about the problems in having to work late because of the erroneous bills generated by the new computer system. In the index file, you would enter one or more lines containing your index words or categories (Figure 9).

This file was then passed on to the SCRIPT program which generated the index (Figure 10). In addition to demonstrating the categories, the Index also could be used to locate passages and obtain simple frequency counts of occurrences within different categories. After reviewing a draft of an Index, I went back and altered, deleted, or added index commands as I refined the categories.
<table>
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<th>Index Commands</th>
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<tbody>
<tr>
<td>Communication inter-group friction</td>
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<td>Communication inter-group friction</td>
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</table>

**Figure 9:** Index Commands
Figure 10: Category Index
3.4.1 Other Data

Other data gathered for triangulation was not placed entirely on the computer because of limitations of time and resources. This data in general was less cumbersome in that it was screened, i.e., selected observations, phrases, and portions of documents had been recorded. The process of going through this data manually was not that difficult.

3.5 Verification Meetings

In February 1982, after I had performed an initial analysis of the data, I met with individuals in each of the settings (a private meeting with the senior manager followed by a group meeting with the first-line supervisors and managers). The purpose of these meetings was to:

- share my preliminary findings,
- obtain some feedback on the validity of my findings from their point of view,
- provide an opportunity for interactive discussion of the findings and other ideas (as opposed to passive reading of the dissertation),
- determine if any findings might potentially and unintentionally (on my part) cause problems for staff or supervisors or managers or the department, and
- provide personal closure for them and myself.
3.6 USEFULNESS OF THE STUDY

In *The Structure of Scientific Revolutions*, Kuhn (1970) stated that people pursue science for four reasons: the excitement of exploring new territory, the desire to challenge existing knowledge, the hope of finding order, and the desire to be useful. The selection of the research problem, data collection methods, and analytic approaches discussed thus far have addressed all four reasons. The case study approach, however, with companion ethnographic methods and limited scope, is often challenged on grounds of usefulness—how does one person's opinion on one setting provide useful knowledge for the rest of the world?

Reasons for selecting the case study approach were discussed earlier. At this point, attention should be paid to ways to make the data collection methods, analysis, and reporting results more than just one person's opinion and meaningful beyond the one or two settings examined.

In a recent article, Guba (1981a) dealt with this concern—the trustworthiness of data collected through naturalistic inquiry. First Guba distinguished between the rationalistic and naturalistic paradigms. He related rationalistic terms such as internal validity, external validity, reliability, and objectivity to larger concepts of truth value, applicability, consistency, and neutrality. He then defined naturalistic terms that relate to these
more general concepts: credibility, transferability, dependability, and confirmability. Once these terms were defined, he went on to explain data collection, analysis, and reporting techniques that attempted to achieve the goal of trustworthiness underlying those concepts.

3.6.1 **Trustworthiness of this Study**

This study attempts to provide credibility, transferability, dependability, and confirmability through the following techniques.

- triangulation;
  - two settings;
  - informants, whenever possible,
  - data collection methods (interviews, observations, documents), and
  - analysis (two approaches to keyword list)
- collection of referential adequacy materials;
  - audio tapes and transcripts of intensive interviews, and
  - copies of key documents
- member checks during interviews;
- verification meetings;
- peer debriefing;
- theoretical/purposive sampling;
- thick description;
• audit trail recorded (research events, documents, records, analysis techniques);
• prolonged engagement (three months); and
• persistent observation (three months).
Chapter IV

THE DIVISION OF WATER

Technical change is like a bomb explosion.

(Trumford, 1967, p. 16)

Between June and January, I can't tell you how bad that job was. It was just terrible. I don't know how we survived.

Staff Member, Division of Water

Bookkeeping was just amazed at these huge stacks of reports, and no one knew what to do with anything ... that place was like a war zone.

Staff Member, Division of Water

This chapter begins with a description of the organizational structure and functions of the Division of Water and the particular activities examined during the research project. The narrative then proceeds with a description of the design and implementation of the computer system. The chapter ends with an analysis of the interaction between the staff and the computer system.
4.1 DIVISION ORGANIZATION

The Division of Water was one of the two major revenue-producing units in the City of Columbus, Ohio, government. The Division was responsible for providing and maintaining water service to approximately 200,000 dwellings, business, and subdivisions in the greater Columbus area. Main units within the Division included (Figure 11):

- Engineering
- Distribution
- Personnel
- Administrative Services
- Supply
- Data Services
- Customer Services

The Data Services area, which organizationally was separate from other areas, was responsible for coordinating various computer system activities. There were two employees in this unit; both were heavily involved in system design and implementation. This area had primary responsibility for providing an interface between the city's Data Center and Division departments.

The second revenue-producing division in the city, and the brother to Water, was the Division of Sewerage and Drainage. While their engineering, field, and planning activities were separate from Water's, the two divisions
shared the billing and accounts receivable system, with Water handling the majority of the clerical work.

Customer Services was the main unit studied. Within this unit or department there were five "activities" (Figure 12):

Figure 11: Division of Water Organization
• Meter Reading
• Consumer Service (Inspection)
• Meter Maintenance
• Customer Relations (Customer Services)
• Accounts Receivable (Bookkeeping)

(The names in parentheses were the old, but still most frequently used, titles for these activities.)

The first three areas mentioned were primarily field activities. The latter two areas, Customer Relations and Accounts Receivable, were the major clerical or office activities; the vast majority of data was collected in these areas. These two activities had major responsibility for clerical duties related to customer accounts. The clerks' work typically involved daily, and, in some cases, constant interaction with the computer system.

While the workers in the field activities did not have frequent face-to-terminal interaction with the system, their work often had an impact on the system. For example, the meter readers turned in slips of paper (scanner tickets) at the end of each day. Each ticket had the meter reading for a particular house or meter. These tickets were passed through an optical scanner, and the meter reading was entered into the computer system database. Bills eventually were generated based on the reading. If the scanner, for some reason, could not interpret the marks on
the ticket (poor erasures, marks outside of lines, wrinkled paper), the ticket was rejected and returned to the Accounts Receivable clerical section for further review and correction. Eventually Accounts Receivable had to enter manually (via a terminal) the proper reading and file the scanner ticket by zone, street, and house number along with the other tickets that were not rejected.
As another example, the Customer Services Representatives answering the phones would note a high meter reading when a customer called in about a bill. This might have been a correct reading or the result of an improperly scanned ticket or the meter reader's writing down the wrong numbers. A re-reading (call-back) or an inspection of the property for leaks or other problems might be scheduled. Then, once the validity or invalidity of the reading was determined, someone in Accounts Receivable adjusted the bill or noted the conclusion of inspection or other "bill research" on the system. The clerk who initiated the call-back was responsible for eventually notifying the customer of the Division's conclusions. Such intricate relationships and interdependencies were typical within Customer Services. Even though the focus of research was on the Customer Relations and Accounts Receivable activities, the impact of other activities on their work was always evident. The lines in organizational charts do not always indicate such horizontal relationships.

4.1.1 Customer Relations (Services)

Customer Relations (usually referred to as Customer Services) was responsible for facets of the department that interacted directly with the customers (the newer name was consumers). The telephone area was located on the third
floor of one of the city's office buildings. Staff within this area generally included 15 Customer Services (Relations) Representatives (often referred to as "reps") who were responsible for answering and processing customer phone calls and mail. Three additional clerks were responsible primarily for typing and filing activities. Two Assistant Supervisors oversaw these activities. Typical processing included:

- inquiries about bills (usually bills the customer considers too high)
- requests for repeat meter readings
- requests for inspections
- requests to terminate service ("final" and "turn off")
- requests to initiate services ("contract" and "turn on")
- name and address changes

While the number of calls received and pieces of mail opened varied, an average monthly volume was 17,000 calls offered, 9,000 calls processed, and 2,600 of mail received.

The second section of Customer Relations, the Public Office, was located on the first floor of the same office building. The Public Office was responsible for handling customers who walked in off the street (about 1,600 per month). The functions were similar to those performed on
the third floor except the two or three persons in this area also:

- accepted cash payments
- handled delinquent payments, particularly for water that had been turned off
- drew up promissory notes to establish a payment schedule
- dealt with irate customers, in person

For one or two years, Customer Services tried rotating Service Representative between the phones and the Public Office. Finally, after a lot of anxiety, mix-ups, and mistakes, supervisors and staff agreed to assign people more permanently to one of the two locations.

4.1.2 Accounts Receivable (Bookkeeping)

During interviews, Accounts Receivable was almost always referred to by its prior-to-system-installation name of Bookkeeping. The activity was divided into of Bookkeeping. The activity was divided into four areas (Figure 12). Records was responsible for maintaining all records related to customer accounts. The plan had been to microfilm many of the reports and documents, but broken equipment usually had made this impossible. Work Distribution was in charge of passing out the "truckload" of reports that arrived daily from the city's Data Center a few blocks away. They
also distributed smaller volumes of requests, reports, and forms generated on the Division's few local printers. Data Entry was a centralized operation whose members keyed in new meter readings, cash intake, and other adjustments channeled to them from all other areas within Customer Services. The Reports section reviewed reports and other documents (including bills) generated by the system. Their jobs, probably the most diverse within Bookkeeping, involved a lot of clerical detective work—tracking down the history of a bill being challenged by a customer, randomly checking bills about to be sent out for their reasonableness, pulling bills that (according to reports from the computer) seemed unusual, and otherwise checking what the computer system generated.

In Customer Relations, the job titles were relatively homogeneous. In Bookkeeping, there was little relationship after system installation between a title and a job, and little consistency among jobs titles when people were performing similar tasks. The titles included: Account Clerk I, Account Clerk II, Clerk II, Typist Clerk II, and Data Entry Operator Trainee. These staff members were paid less than the Customer Services Representatives, even though the complexity of the work (although not the level of direct customer contact) was similar. The dissimilarities in pay within their own work group and compared to other
activities was a constant irritant to the Bookkeeping staff. (In October 1982, the Division had been attempting for over six months to reclassify the jobs in Accounts Receivable to a more generic, higher paying title of Billing Specialist.)

4.2 PHYSICAL ENVIRONMENT

The various offices of the Division were scattered all over town. For the past couple of years, most of them had been crammed (their perception) into a remodeled shoe factory in the middle of downtown Columbus. All offices were open landscape. About half of the Customer Services offices were on the first floor: Meter Reading, Consumer Service (Inspection); Meter Maintenance; Accounts Receivable; and the Public Office of Customer Relations. On the third floor were the administrative offices, Personnel, Data Services, and the telephone section of Customer Relations. Until December 1982, Engineering also was on the third floor.

On either floor, clerks typically had an area about 8'x8' which was their own, most of which was occupied by a desk and chair. The computer CRT terminal typically occupied 30% or more of the desk space. Activity supervisors usually had a little more space but rarely more privacy. Their work space frequently was invaded by paper and
equipment which wouldn't fit (physically or logically) anywhere else. The areas usually appeared cluttered, particularly in Bookkeeping, where hundreds of printouts were awaiting review or microfilming.

The lack of physical proximity for related sections and functions (the distance between the third and first floors) seemed to help separate the people in those functions. One person noted that if everyone were on one floor, it might seem to them more that they all worked for the same division.

Staff members in Customer Relations and Bookkeeping found their physical environment, in general, lacking in space and cleanliness. Most Customer Relations Representatives felt the need for more space, more sound barriers, and real CRT workstations in order to improve their job performance.

4.3 COMMUNICATION

In the phone area, close proximity facilitated frequent interaction, either intentional or unintentional, between employees. It was quite easy to make a loud statement such as "Is your terminal stuck?" Everyone else in the work group would hear it and respond "Yes" almost in unison. Many times such talk seemed to act as a release valve for
the tedium of sedentary work and the stress of interacting with customers all day long. Typical conversational topics included: discussion of the slow response time of the system; the system's being down or stuck; funny customer calls; problem customer calls; and socializing among friends. There were several reps who had loud voices, and those voices became louder when they were talking to an irate or confused customer. These peripheral one-sided conversations could be very distracting. The verbal and visual cues in the environment were overwhelming at times. Many of the reps had learned to block those cues out.

In such a setting, each clerk's behavior was constantly subject to the scrutiny and evaluation of peers as well as supervisors--someone was watching, someone was listening, someone was deciding whether or not that behavior was appropriate. On paper this was the supervisor's role, but it was the clerks themselves who had access to the most evaluation data. Preferences arose, cliques formed, pathways of friendship were burned into the air and worn into the carpet. Those friendships provided the infrastructure for work.
4.4 THE WORK

4.4.1 Customer Relations

The supervisor, in the midst of what appeared to be organized chaos, was responsible for seeing that the work was done. On the surface, the work appeared to be simply defined: answer the phones and help the customers. To monitor efficiency, there was a small computer system (the Star system) which kept track of how many calls were offered (received but not necessarily answered), how many were answered, and how long each clerk was or was not on the phone. At regular intervals, the Star system ground out (the noise the printer made was like a dentist's drill) a statistical report of how much answering and talking was being done at each station. Twice a day, the clerk received the portion of a printout detailing his or her performance. Sometimes there was a statement like "good work!" written by the supervisor on the printout. Typically the rep glanced at the printout and then put it on the desk, filed it in a drawer, or tossed it in the trash can.

The number of calls processed was a superficial, yet easily obtained and measured, way to monitor efficiency. It was the measure used to set objectives not only for the individual reps but for the activity and, in part, the Division. Phone calls not answered worked their way into other offices. If you couldn't get through on one line,
you simply kept calling other offices under "City of Columbus" until someone answered, and then you complained about your water bills and about the inefficiency of city government which your tax money was supporting. In the end, the content and repercussions of the call would work their way back to Customer Services. In their wake would arise management's obsession with "answering the phones."

Answering the phones, however, could be a complex task which eluded simple quantitative measures. Some requests were simple: change a billing address or close out an account. Even simple requests could require complex thought and system processing. Consider the processing involved in a fairly typical call—an inquiry about a "high" water bill.

First, the rep had to determine the proper account. This was done through the Service Address screen on the computer system. Once the account was located, the rep could then pursue several investigative routes: look at the account balance to see if the customer has a reasonable payment history; review the meter readings to look for sudden changes in meter reading patterns; check to see if there had been recent Service Requests for that property (e.g., inspecting for water leaks); ask the customer how many people lived in the house (calculate number of people
times average water consumption per person); or ask the customer if he or she had noticed any leaks or "running" toilets. Most of the time, it was clear to the rep, but not clear to the customer, that there was nothing unusual about the bill—it was not that much higher and sometimes lower that other bills the customer had received. (During October, when I was observing, customers were receiving bills for summer water usage which often was higher because people water their lawns and take more showers; rep after rep reminded customer after customer of this fact.) If the customer insisted that there was something wrong or the rep thought the bill was suspect, the rep could schedule a repeat meter reading (a call back) or an inspection. In both instances, the rep had to make sure that the meter reader or inspector could get access to the meter or get inside the house. There were discussions of where keys were to be left, what neighbors to ask for help, and dogs of which to be aware. If it was a landlord calling about a tenant property, arrangements could become more complex. The customer, perhaps with a glimmer of hope that he or she wouldn't have to pay all that money, would hang up.

The call, however, wasn't over. If a Service Request for a meter reading, inspection, or bill research had been entered on the system, the rep would note this on a slip of paper. A letter or bill might be quickly drafted for
someone to type. These little bits of paper would be placed in a tray, usually on top of the terminal. About once an hour, a clerk would walk around and pick up these slips of paper for further processing.

This was the process involved in an average phone call. Once it was over, it was time to answer the next call, and the cycle began again. There were about 120,000 of these calls processed each year. Some were simpler than the one described, but many were more complex. In my short time observing I listened in on conversations involving water shut off accidentally, water turned off due to non-payment, water turned on, in spite of non-payment because there was paraplegic or someone with a heart condition or five children, initiating service where someone else is going to pay the bill, and the tracking of mystery accounts—the water was on but it was not clear who was being billed. Comments from the reps about work included:

One thing about this place, it's never boring.

When I first started working here, I felt sorry for a lot of these people, but not any more.

The work is boring sometimes.

You ought to be here when there's a full moon; the calls are really crazy then.
4.4.2  **Bookkeeping**

In the first-floor Bookkeeping activity, the work was quieter and the atmosphere more subdued. While stacks of printouts and crowded desks made an interesting obstacle course, clerks went through maneuvers with relative ease. Much of the processing was the same as upstairs—looking at bills, looking for possible problems, and researching those problems. Bookkeeping, however, had much more access to paper, and work frequently was based on those papers and paper processes.

Bookkeeping's structure and functions had changed dramatically during the previous year, but in general had settled down to what might be described as a quality control role. Before bills were sent out, clerks randomly checked for reasonableness. The system also printed lists of questionable bills and accounts; the clerks worked from these reports to examine and research potential problems. Inquiries via phone and mail usually ended up in Bookkeeping at some point, if for no other reason than to be entered onto the system. Downstairs was where bills were finally adjusted and Service Requests closed out.

Employees in Bookkeeping seemed far less vocal than their counterparts upstairs, both in talking with one another and talking about their work. They were not without
complaints, however. Their basic complaint was about pay, and the focus of the complaint always centered on the fact that their pay was far less than that of the Customer Services reps even though the content of the work was very similar. The competence of some of the Service Reps was doubted; they disliked having to work on "problems" that weren't really problems, just something the rep didn't but should understand. The pay discrepancy was a constant source of irritation and dissatisfaction. As mentioned earlier, the Division had been attempting for months to have their positions reclassified. The continuing lack of progress in this area upset everyone.

4.5 THE UNION

Some mention should be made of the union. Almost every Service Representative in the Customer Relations area belonged to the union (APSCHE). Of those members, one was the Chief Steward for the Division of Water, and at any time one or two others held offices and were very active. Several people believed that this union involvement, rather than the difficulty of the job, was the reason the reps were so highly paid. This was a prevalent opinion among Bookkeeping staff, most of whom were not in the union.

A side effect of the unionization of staff may have been a combative relationship between supervisors and staff. One manager noted:
They're almost 100% unionized, and that has to do a lot with the type of supervision they have to get. That too puts pressure on them. If it was a non-union group and there was low production, maybe not as much would be said about it. Because they are union, and because the chief steward's back there, she tends to complain very quickly and very loudly about something. Because of that, whenever they make a mistake, they get it just as quick and just as loud. It has a personality all its own.

The union, either directly or indirectly, was a pervasive element in the working life of the clerks.

4.6 THE COMPUTER SYSTEM BEGINS

The planning for the Water and Sewer Utility (WSU) Billing and Accounts Receivable System began in 1978; the system went into place in June 1981. The three-year period in between was marked by starts, stops, and revisions as the project meandered due to lack of money, lack of staff resources, and, as one manager noted, a lack of leadership.

There was little expertise and little staff time in-house, so Water hired a consulting firm to propose a system design. It was assumed that the actual programming, development, and implementation could be done by the city's Data Center. The consultants spent the first few months documenting the old system, then the "conceptual" design phase began. The conceptual design document was published in April 1979.
The old system had been semi-automated. Meter readings had been on-line, and the reps could look at them when talking to customers. The billing and accounts receivable, however, were left in the hands of the bookkeepers—they were responsible for preparing the data (mostly on key-punched cards) to generate the bills. The old system left the responsibility for initiating bills in the hands of the clerks. The automated end of the old system, however, had been modified and patched many times; the cracks were beginning to show.

The consultants examined existing procedures and talked with managers, supervisors, and clerks. How much they talked with staff is debatable. While all persons interviewed agreed that supervisors were asked for some feedback and ideas, the majority agreed that there was far too little input from the supervisors and almost none from the clerks. One manager noted that he automatically had assumed that supervisors had talked with their subordinates about ideas and issues related to the system; he later realized that this had been a false assumption. Several people thought that when the consultants did talk to staff they were just going through the motions; the consultants already knew what the system was going to look like. One person described fairly closely the "hostage" model of participation noted in Chapter II:
What happened is simply this. No one from the Division had the education or the insight into the problems that we were facing to know what was a good or bad decision. Therefore the consultants could really dictate or strongly suggest something, and everyone would buy into it because we didn't know any better.

The Division, however, had appointed a staff member, previously a supervisor, to work with the consultants. Her role, official liaison between the computer and the real world, was often difficult. Even when efforts were made to communicate and solicit feedback, there was not enough time or enough understanding. She was placed many times between the consultants and Water, and was a prime target for blame when anything went wrong.

The apparent lack of participation by staff in the design was cited repeatedly as a major cause of the problems experienced during implementation. London (1976) stated that this is a major cause of system failure. One staff member noted that though some people were involved in the design, they lacked experience to know what they were doing.

It's interesting because what happened was that in the design of the system, you went through and you asked people "What do you want? What do you really need? Are you sure that you want that?" And, of course, they get it. And then, all of a sudden, you know, they get volumes of paper and they're overwhelmed. Then they say, "Did I really ask for this? I don't even know what all this stuff means."
There is one interesting piece of data that supports the perspective of non-inclusion of the staff in the design process. The first page of the design document examined had a small paragraph that had been added to assist in the circulation of the document among the staff for review. It said, quite simply, "This document was not written for you." It went on to explain that you were not supposed to understand it entirely, just read it.

The system outlined in the conceptual design had six major processes:

- on-line inquiry
- on-line update (limited)
- on-line transaction generation
- on-line input edit and transaction generation
- batch update
- batch report

The general result of the these new processes would be that:

- more information was available on-line rather than on paper
- some updates could be done at the terminal instead of entered on cards
- bills would be initiated by the computer and accounts received via the computer, rather than by the staff in Bookkeeping
The document described, in some detail, system processes, document flow, data elements, database composition, and the all-purpose generic "user." It was a classic computer system design document, replete with flow charts and technical descriptions yet void of discussion of how the people in Water (not "the user") were supposed to fit in with the system.

The conceptual design was published; the consultants disappeared. The design was passed onto the city's Data Center as a basis for the next steps of detail design and implementation. Nothing happened. There was no time and no money to pursue the project; there were other things to worry about, other fires to fight.

A year passed. The old computer system was beginning to crack. Bad bills were appearing. New rates were probably going to go into effect, and the existing system wouldn't be able to handle the change. Water began to put pressure on the Data Center to get the new system project going, but nothing happened. The Data Center was "floundering" in the midst of personnel turnover, with an immediate recovery not in sight.

In October 1980, the consultants were again called in, this time to work with the Data Center on the detail design and implementation; the system had to be completed in less
than a year. The design was trimmed to cut costs, and then the staff started. The consultants brought in four programmer/analysts, one programmer, and one manager. The Data Center assigned three programmers. Water put two staff members into the project for coordination with the users, documentation, and training. Two committees began meeting. The User Management Committee, composed primarily of middle managers, worried about processing issues and problems. The Steering Committee, composed of high-level administrators, some of the consultants, and Data Center personnel, was responsible for making decisions regarding implementation. No one in Water who was expected to use the system on a daily basis from a terminal was included in these groups. The rules of bureaucracy were observed.

By late May, the implementation was well underway towards the target summer conversion date in July or August. Programs had been written, but not tested; documentation was being drafted; and training was being planned. In early June, it came to the attention of the Steering Committee that the Auditor's Office (long a rival for Data Center resources) planned to put up its new payroll system in July. It was believed that if the Auditor's system went up first, there wouldn't be enough disk space (permanent computer storage for information) for Water. The Superintendent of Water decided to move the conversion date up to late June--June 22.
In retrospect and by several people at the time, this decision was seen as the major cause of the massive problems that occurred in the ensuing months. Many said there should have been at least a couple of months when the old and new systems were running in parallel; others doubted that this would have been possible. The main tone around the conversion date and experience, as people were interviewed months later, was confusion. People said the system went on-line in late April, May, and June; no one knew the exact date. Reasons for moving the date up included that Water wanted to be the first one with a new system, the consultants' contract needed to be terminated, and many couldn't even guess. Likewise, there were creative interpretations of how far the conversion data had been moved up, anywhere from one to six months. Emerging from these varying descriptions was a pattern that the reasons for a decision that affected the staff apparently had not been communicated.

4.7 REORGANIZING BOOKKEEPING

Shortly before conversion, management began dealing with the problem of Bookkeeping—their existing clerical functions would be obsolete when the computer system went into place. The computer, not the clerks, was going to keep the books. New functions and job roles needed to be found.
Bookkeeping was reorganized, apparently without the participation of the people whom the reorganization would directly affect. The new structure was put into place when the new system went up. One clerk affected by the change described her feelings. (Bold type indicates the interviewer's questions.)

The way I saw it being done or the way most people on that level saw it—we knew something was happening, and something would have to be reorganized. It was probably a Thursday or Friday, right before a holiday. They sent a memo around saying these are the new sections; these are the new supervisors; this is the way it's going to be. I think there should have been more discussion about it.

Why would discussion have helped?

Because people felt like—they already felt like the system was being pushed on them, and they had no idea of where they were going to be when we went on-line. They obviously didn't have any choice by that being done. I think it made them feel even more pushed on by the system by having that done. By just saying this is the reorganization. They didn't discuss it with any of the employees at all.

4.8 IMPLEMENTATION

The system was available for inquiry only on Monday, June 22, 1981. On June 23rd, they began putting new information into the system. The clerks had received some training on how to use the screens; they had worked with sample, ideal data. Now, they were using the real data.
The Steering Committee and User Management Committee
Minutes for July were smattered with reports and lists of
things that were wrong. People were assured that such
problems were typical when new systems were installed;
everything was under control. By August, optimism began to
fade. In converting to the new system, there apparently
had been some mistakes. There were problems with the bill-
ing programs. The reps couldn't understand the Account
Balances screen. Bookkeeping, total reorganized, was with­
out an understanding of the reports, the system, or their
new functions. Perhaps, worst of all, it was the customers
who were discovering many of the mistakes during the "bad
bill" phase. The following description is from one of the
Customer Relations reps.

We've gotten so many bad raps. I'll tell you
that whole phase of the bad bills, that was aw­
ful. No one knew they were bad until the custom­
ers started to call in. But you didn't have an
answer. The customer would call and say "Some­
thing's wrong with my bill." You call up the
screen, but what they're telling you isn't on the
screen; what they're telling you is completely
different. So you say "Well, let me research it.
What is your phone number?" And you hang up and
think "That is really odd." Then your next call,
it's the same thing, and you think "Um. Two of
these." And then the person next to you says
"You know, I had a call. . .", and all of a sud­
den it dawns on you--there are a thousand bills
out there that are messed up.

Then you tell your supervisor who takes their
time telling someone who takes their time . . .
Finally someone says, "Well, maybe we ought to
look at them." You see, you have to convince
them. They think that's just an isolated inci­
dent-- don't worry about it, just keep taking
calls please. But the whole time you don't have an answer. And the people keep calling, and you keep saying, "Yes, we are aware. There is a problem. There were 500 erroneous bills sent out, and we are aware of that. Just give my your account number and don't worry about it." What are we going to say? It's two days later and no one has given us a decision on what we're going to do about it. What do we tell the customer--we're still checking it. The whole time . . . And what was 500 turns into 1000 and what was 1000 turns into 5000. Is it going to end? Just as soon as we finish two weeks worth of maddening calls and researching and working overtime, they send out a whole new batch of incorrect bills. This went on.

In Customer Relations, the number of phone calls skyrocketed, but answering them was much more time-consuming (Table 1). The screens showed different data from what the customer had; the response time was slow (sometimes 30 seconds between screens); some of the screens (notably the Account Balances) even if correct were difficult to interpret; and the system was down or unavailable a lot of the time.

If the phones were busy, customers sent letters or left messages in other city offices. The work piled up.

Of course anytime they can't get through on the phones, they write letters, and we just got thousands and thousands of letters. We had storage boxes crammed and stacked all over the room. And we are just down now to about 200 letters.

When they mailed out all the bills that were wrong, and then gave everybody double credits for their payments, it always tickled us because they would say well, this only happened on 6000 accounts. But no one really knows how much time it takes to process 6000 customer calls or answer
<table>
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<tr>
<th>Year</th>
<th>Month</th>
<th>Calls Offered</th>
<th>Calls Processed</th>
<th>% Calls Processed</th>
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<td>11,203</td>
<td>8,275</td>
<td>73.9</td>
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<td></td>
<td>February</td>
<td>13,256</td>
<td>10,712</td>
<td>80.8</td>
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<td>March</td>
<td>10,884</td>
<td>9,514</td>
<td>85.4</td>
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<td></td>
<td>April</td>
<td>13,349</td>
<td>10,809</td>
<td>81.0</td>
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<td>May</td>
<td>13,106</td>
<td>11,692</td>
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<td>18,913</td>
<td>10,592</td>
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<td>July</td>
<td>26,696</td>
<td>12,195</td>
<td>45.7</td>
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<td>21,222</td>
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<td></td>
<td>December</td>
<td>16,131</td>
<td>8,956</td>
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<td>September</td>
<td>19,353</td>
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<td>October</td>
<td>16,486</td>
<td>9,836</td>
<td>59.7</td>
</tr>
</tbody>
</table>

* new computer system installed

**TABLE 1**

Telephone Calls Processed
6000 letters. So out of the total number of accounts we have, it may not seem like very many, but to us it was quite a task.

By September 1981, there was no more optimism and no trust that the computer system was generating accurate bills. When one problem was corrected, another might be generated. Fixing one part of a bill might cause a mistake in another part. Quarterly billing was suspended. The press release stated:

The Columbus Division of Water is in the process of implementing a new automated water and sewer billing system. Due to technical difficulties in converting approximately 5 to 10 percent of the accounts to the new system, it has become necessary to delay all scheduled quarterly billings for several weeks. This action is necessary to assure accurate billings. All meters will be read as scheduled. Billings, when received, will reflect each account's normal consumption and charges for the scheduled meter reading period.

The system had generated so much misinformation that it was impossible to be sure which accounts were really delinquent and should have their water turned off (the only payment enforcement mechanism a utility has). So in October, turn-offs were suspended. No bills and no turn-offs meant less money coming in, and revenue dropped. (Recall that Water and Sewers were the major revenue-producing areas of the city.) One person, describing the job attitude timeline he had drawn explained:

The reason this is so low is that we actually suspended turn-offs in October '81. We didn't know who owed, who didn't owe, we could not go
out there and turn water off. Therefore what happened—now, revenue dropped. The auditor's office went beserk. That was madness. So when we started to turn off again, of course we turned off a lot of people we shouldn't have turned off, because we honestly didn't know.

The repercussions of this suspension went on for months, even when billing and turn-offs were resumed.

Because of the bad bills we were sending out in the late summer, we had to suspend turn-offs, which was our big enforcement turn-offs. So when we suspended turn-offs, for almost three quarters, then you have these persons out there that once they realized that there was not a threat of turn-off, then they would not pay. Now we get to a point where we put turn-offs back in force. There are all these people who now have to be reeducated to pay their bills on time.

And they have huge bills.

And they have huge bills that they have not been paying. It made our promissary notes just skyrocket, and now we're turning off a lot because of default of promissary notes. Now people are trying to pay off promissary notes along with their regular bill. That can definitely be attributed to the implementation of the data system. Our budgets were very negatively impacted because of the data system.

In addition to having to deal with bad data, Water was working on a slow and unreliable system. Response time between screens usually was more than the ideal maximum of seven seconds. For the reps on the phones, this was intolerable; during that time, they would be sitting, in silence, waiting for the system to respond. At the end of the day, they would hear about all the calls that hadn't been answered while they were waiting. The system
recurrently was unavailable due to hardware (equipment) and software (program) problems. The average downtime during the first six months was 20% (Table 2). Even when the system was not available, reps were still expected to answer phone calls for which, most of the time, they could not provide answers because they did not have access to information.

In Bookkeeping, the new system brought huge mounds of printouts, and no one was quite sure what they were supposed to do with those stacks of paper. The reports, due to the instability of the system, were erratic in their arrival, and efforts were made to distribute them in an orderly fashion (even though the people to whom they were distributed often didn't know what to do with them). One clerk described dealing with the reports.

I can't remember exactly when, but for the first two weeks, I was totally lost, and it was scary. We actually didn't know when we were doing something how it would come out. We were afraid how it would come out. I guess after the first few months, I got to the point where I could even use the reports. We had reports coming over that we didn't know what to do with, and we didn't know where to look for information.

While the front-line staff on the phones were fighting off the onslaught of customer phone calls, the staff in Bookkeeping was trying to figure out what had happened and how to correct it. The problems were compounded by the fact that the reorganization—new job roles and new job duties—
<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Total Minutes Unavailable</th>
<th>% Work Time Unavailable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>January</td>
<td>1974</td>
<td>17.4</td>
</tr>
<tr>
<td></td>
<td>February</td>
<td>575</td>
<td>5.0</td>
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<td></td>
<td>March</td>
<td>307</td>
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<tr>
<td></td>
<td>May</td>
<td>92</td>
<td>0.8</td>
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<tr>
<td></td>
<td>June</td>
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<td>11.1 *</td>
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<td>July</td>
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<td>August</td>
<td>4166</td>
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<tr>
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<td>September</td>
<td>2303</td>
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<tr>
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<td>October</td>
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<tr>
<td></td>
<td>November</td>
<td>606</td>
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</tr>
<tr>
<td></td>
<td>December</td>
<td>2460</td>
<td>21.7</td>
</tr>
<tr>
<td>1982</td>
<td>January</td>
<td>1541</td>
<td>13.9</td>
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<tr>
<td></td>
<td>February</td>
<td>1521</td>
<td>13.4</td>
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<td>1820</td>
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<td>5.0</td>
</tr>
<tr>
<td></td>
<td>November</td>
<td>438</td>
<td>3.9</td>
</tr>
</tbody>
</table>

* system installed

% Work Time Unavailable = total minutes unavailable

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21 days x 9 hrs x 60 min

**TABLE 2**

Time Computer was Unavailable
had happened at the same time. The phone staff had had a shift in responsibilities; Bookkeeping had undergone a complete structural change. One staff member from the 3rd floor phone area described the difference.

I mean, we really had it bad, because the customers were harassing us. That makes it really hard on the girls when they answer the phone and they have to spend the first five minutes chastising you and telling you how many times they've tried to call, how long they've had to wait, how stupid we are, so that doesn't help things up here. But Bookkeeping was just amazed at these huge stacks of reports and no one knew what to do with anything. I just threw all mine out so at least it would look clean, but that place was like a war zone. We kind of had by September pretty much figured out what you had to do with various kind of things. We were tremendously far behind, but we knew how much stuff we had to catch up on, and we kind of had a plan for dealing with it. But they had nothing in Bookkeeping.

During the early Winter of 1982, a sewer line close to the office building froze, water backed up, and came pouring through the ceiling in the first floor Bookkeeping area. The Division of Water was flooded. One clerk said, "We had plastic like diapers hanging down from the ceiling; it was awful." The stacks of paper were soaked; people were afraid that they would be electrocuted when they touched the terminals. The flooding was a last straw, and, at some level, a symbol of everything else that had been dumped on those clerks during the previous months.
During the Winter of 1982, the consultants were again hired, this time to help straighten out and define the procedures and job roles in Bookkeeping. The visible products of this effort were: a procedures manual; a report on workload analysis; and a description of modifications and enhancements for the system. For the clerks, however, the result was an increased understanding of the data system and how to relate their jobs to it. It was the first time they felt someone whom they considered knowledgeable (a computer expert) had sat down, listened to them, and explained how things worked. In the middle of his report, the consultant buried this recommendation for better communication and training:

This recommendation suggests that all management guidelines, directives and procedures be written and discussed with the various activity supervisors before they are implemented. It is not sufficient just to write up a procedure because it may not be fully understood. The review and discussion with the supervisor is essential in that potential misunderstandings will be eliminated.

By Spring 1982, life in the office had begun to improve. While there were still problems with bad data, a major part of the backlog generated during the bad bill phase had been cleared up. The Steering Committee disbanded in March 1982. A major problem persisted with delinquent accounts that had not been turned off and massive bills that had been allowed to accumulate.
The major campaign, however, was over, and efforts were now directed towards smaller forays: correcting small but persistent problems, writing procedures, and documenting poor response time and machine performance. As the smoke of bad data lifted, it became apparent to staff and managers that a major problem was not with the software but with the computer equipment they were sharing with other divisions. In August 1982, Water was placed on their own computer, and everyone noticed a dramatic improvement in response time; the attitude toward the system began to change.

In October and November, 1982, the general attitude was one of tolerance, particularly if the response time was good. Everyone had their war stories of their experiences during the first nine months, but their main concern was to have a system that was fast and reliable enough to get their work done. In Bookkeeping, there was still a lot of dissatisfaction with job titles and pay, but few complaints about the work itself. Management was beginning to focus on some more global and profound organizational issues: decentralization of data entry; specialization within and between jobs; and Water's having total control over their own computer system. Managers were eager to switch from a patchwork to a planning mode:

'We've been running around for a year sticking our finger in different holes in the dike and not really worrying about building a new dike.'
London (1976) summarized the eight most common faults found in 25 computer systems in eight companies:

1. Reports generated are inadequate or redundant.
2. There is low data accuracy.
3. Schedules are often missed, causing delays and confusion.
4. The hardware (equipment) capacity is quickly exceeded.
5. Remnants of the "old" system are retained; many automated processes are duplicated on paper.
6. Problems and situations occurring at implementation were never anticipated or covered in the design.
7. The system is over restrictive and inflexible.
8. The staff is under more pressure.

These eight faults state, fairly completely, the problems encountered when the Division of Mater switched to their new computer system. What this tidy and classic list does not convey are the effects on the people forced to deal with those systems every day—the frustration, the me-against-the-system mentality, the confusion, the sense of loss of control over one's work, and a loss of trust in themselves, their supervisors, and the system.
4.9 **POINTS OF ANALYSIS**

4.9.1 **System Design, Job Redesign, and Training**

At the end of Chapter II, three areas were described which many authors felt provided the keys to better systems and better human work within those systems: participative systems design, job redesign, and training and education. To understand the experience of the Division of Water in installing their data system, it may help to describe, very briefly, what was done with those keys.

From the point of view of almost all the managers, supervisors, and clerks interviewed, their participation in the systems design was minimal. Many remembered that someone had talked to them or their bosses about what the system should do. Particularly seeing their involvement in the context of their subsequent and current experience, they viewed their participation as being far less than adequate. At the individual clerk's level, it seemed that the system was "pushed on" them.

The only attention paid to changing jobs was in Bookkeeping, and there the focus was on organizational restructuring rather than job redesign. Supervisors and clerks stated that they were not involved in the reorganization. They were handed a memo saying how the activity would be organized; it was a *fait accompli*. While the sections
within the activity and general functions were listed, the clerks had no idea about what they were supposed to do. They had a general idea about the system, but they had no way of knowing how it related to their job. When the consultants returned in Winter 1982, some attention was paid to the relationship between the computer system and job content. For the most part, the group worked the job redesign out by themselves, back into a pattern of each person being responsible for a certain billing zone; they gradually adapted other structures that had been imposed on them.

The early implementation date had forced some of the more thorough training that had been thought about to be abandoned due to lack of time. Everyone received some instruction in using the terminal for inquiry in ideal situations, but no one was prepared for the problem solving that was necessary. No one was ready for the shift to system-based, conceptual thinking rather than paper-based concrete doing. Informal training was constant, and retraining persisted. Each day there was something new to learn, each week there was a different way to do a task than the way you were told to do it last week. There was almost no formal training—there wasn't enough time. Nor was there any attempt at more general education.
One manager summed up the system design, job redesign, and training aspects fairly well.

There was a period in the design that was really underground more or less; it wasn't visible as a design process. Most people didn't feel like they were a part of that design process. Then you have implementation date. Up to that point just about anything anyone heard was rumors. Then you have implementation day, and that's when all of a sudden, here are all the manuals, this is what your new job is going to be, we're going to move your desks around, this is the reorganization. Then for the next year you're having to go through training, through the transition of a physical change, along with the transition of changing of your work. It's just very traumatic, even for a well adjusted employee that's a good employee. It was done wrong, to say the least. There was an awful lot that could have been achieved if they would have done it a year prior to implementation. Then they might have been able to make that implementation a lot smoother.

4.9.2 The Battle Metaphor

This chapter which has described the events in the Division of Water began with three quotations, one from Enid Mumford's *The Computer and the Clerk*, the other two from a supervisor and a clerk in the Division of Water. A common thread through these three quotations and through the interviews, observations, and documents was the symbol, image, and theme of battles--brief or extended struggles between two people, activities, departments, and divisions. Some of these included:

- clerk vs. his or her work
- rep vs. the phone calls
• Bookkeeping clerk vs. stacks of paper
• clerks vs. clerks ("personality" conflicts)
• Customer Relations vs. THE PHONE CALLS
• Bookkeeping vs. THE BAD BILLS
• Service Reps vs. (belligerent) customers
• supervisors vs. the employees
• staff vs. the computer system
• Union vs. the supervisors
• Union vs. the Division
• Union vs. the City
• Water vs. Civil Service
• Water vs. the Data Center
• Customer Services vs. other Water departments

There was always a new battle plan (e.g., agendas for meetings or the newest organizational chart) being drawn up. At best, the combative mentality embued people with the psychic energy to accomplish at times overwhelming tasks. At worst, huge amounts of time, thought, and emotions were invested in tasks that might be interpreted as trivial. The main question was, what was the war about?

4.9.3 The Theme of Trust

If the battle metaphor describes the climate in the Division of Water, the underlying tone and theme that makes that metaphor possible is a lack of trust, particularly a trust of the computer system.
Before system implementation, people had to trust what they had heard about the system:

The bad part about it was, when they were explaining it to me, I had no idea, really, what was going on. I had to take what they were saying. I had to take it as this is what's going to happen. I thought I could trust the system. If I did what they told me, it would work. So I think that was a big problem.

When things didn't turn out as expected, trust and confidence began to erode. Another clerk described the discrepancy between what was expected and what happened.

It [the attitude toward the computer system] was apprehensive. But because they were saying that it was going to be easier, eliminate work... they were maybe hopeful that it was going to make their job a lot easier. Naturally, when implementation began, things weren't working at all, their hopes went out the window, their apprehension proved true.

In October 1982, the lack of trust still pervaded the attitude toward the system. Response time might be good for three days in a row, but if there was a brief interlude (perhaps 1/2 hour) of bad response time, everyone reverted to describing the general response time as being "awful."

Once trust is lost, it is difficult to regain it; memories of disillusionment are difficult to erase. As one person said:

All we knew was that wonderful panacea that we were assured was out there and then it wasn't. We're still finding out things that the system just cannot be programmed to do.
The lack of trust in the system spread to a lack of trust in management. One person described the gradual erosion of confidence as clerks were given new instructions each week.

And then maybe the next week they'd call down and say, "All the work you put in, now we find out that it didn't take. You have to do it all again." That was just very very frustrating, especially to the lower level personnel, who would knock themselves out to meet the deadline only to find that, "Hey, you've got to do it all again." They really lost confidence in management. I don't know how much they had before implementation, but to see everyone walk around and not being able to respond to questions like why did this happen? How are we going to correct this? When will this end? To see your assistant superintendent on down walking around saying "I don't know" -- you really lost confidence. It's going to take a long time to build that back up to. You're not going to see that in the budget or quarterly review or surveys, but it's there.

At another level, the lack of trust evidenced itself as a loss of credibility of the Division as a whole. For one rep, the lack of belief in Water's accounting accuracy was also a customer's lack of belief in the accuracy of her own work:

Then you start to lose your credibility. Which brings us to another frustrating point. It's one thing to be able to sit on those phones and speak with authority and credibility. It is something else to sit on those phones and have to deal with people who doubt your credibility every day. Customers know something's been in the newspaper but no one's bothered to tell me. So we've suffered a lot.
In *Trust and Power*, Luhmann (1976) stated that in complex systems, trust—believing that certain events and people will follow certain patterns and fulfill certain expectations—is a necessary foundation for living within those complex systems. Without trust, too much attention has to be paid to minute details, and too many small decisions have to be made. At some level, the individual must expect a pattern, if not order, in his or her existence to survive and maybe progress. In the less cosmic context of everyday work, one person described this as being in the "job groove": "They're into a job groove that they do the same thing every day. They know what they have to do; they know how to do it."

When the computer system was installed, it made a giant scratch across the record of the clerks' working life. Work was disrupted and distorted, and frustration resulted. One supervisor noted:

There was really a distrust of anything that was on the computer, and still is to a certain extent. It really contributed a lot to the stress that they work under. Because most of them feel, give me the tools and give me the information and I want to do the job. I just want to sit here and take the calls. But they come in all psyched up, ready to work, and they sit down, and the terminal's taking three minutes per screen, and so then nobody wants to work. They're frustrated.
Although trust in the system was still a long way off, most people were beginning to accept it, to learn how to use it more effectively. The passage above that ends with "They're frustrated" continues on this more optimistic note:

They're frustrated. Overall, I think they're starting to accept it. It's nice because you don't have to get up and look two or three places to find what you need. Which is what we had to do before. There was one thing on-line and something else in Bookkeeping and something else in this report. So you really couldn't get everything together on an account. They all complained about having to figure out their own problem accounts in the beginning, but the ones that have gotten pretty well skilled at it, I think they kind of enjoy it, because it gives a little more dimension to their job. It's not just taking a name and address and writing it on a piece of paper, and putting it in your out basket. I think it's made the job more interesting.

Trust in, understanding of, and satisfaction with one's work and working life go hand in hand. Fifteen months after system installation, such trust, understanding, and satisfaction may have been beginning to grow. The Division of Water, 15 months after computer system installation, was close to the point Admissions had been when it installed its own system.
Chapter V
THE OFFICE OF ADMISSIONS

It was just like Christmas on the day the system came up!

They put an announcement of the system's first birthday in the newsletter. We tried to get University Systems [the data center] when they came up in the morning to change the message to say Happy First Birthday, but they didn't have the time to mess with that.

One of the big shocks for us in the past six months, a kind of an afterbirth of implementation.

- - -

Staff Members
Office of Admissions

If everything seemed to go wrong in the Division of Wa­
ter’s effort to install a new computer system, almost everything went according to plan in the on-line conversion effort in The Ohio State University's Office of Admissions. This chapter begins with a description of the office. The narrative then proceeds with a chronicle of the events pre­ceding and following the implementation. Again, the chap­ter concludes with a brief analysis and interpretation of the impact of computer technology on the Admissions Office.

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5.1 ORGANIZATIONAL STRUCTURE

The Office of Admissions was part of a larger unit of Admissions, Registration, Records, and Scheduling, which in turn was part of the Student Services wing of the University. Its primary sister organization was Registration, Records, and Scheduling.

5.1.1 Office of Admissions

The Table of Organization for the Admissions Office is shown in Figure 13. There were four main areas:

- Admissions Operations
- Systems Support
- Freshmen and Undergraduate Counseling
- Graduate, Foreign, and Professional Admissions
- Information Center

These four areas could be collapsed into two general functions: counseling (in person and on the phone) and application processing. Within the processing-related areas, those in Admissions Operations probably saw themselves at the center of the processing function—they received, reviewed, and forwarded the applications. The Systems Support area provided support to that general processing function. Data Services took care of the mail—opening mail,

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2 The University went through a major reorganization in early 1982, about six months before the majority of interviews. Admissions was included in that reorganization.
routing mail, and sending out information. Creds (credentials) Control maintained the manual files still kept for each applicant. Systems Development and Support had one staff member who was responsible for staff training technical liaison with the programmers for the on-line system.
The Associate Director was responsible for the two processing and support areas.

The total staff included 8-10 managers and counselors and 40-45 civil service employees. The Associate Director, Assistant Directors, Coordinators, and counselors had university administrative and professional appointments. The other staff members had civil service jobs at these levels: Clerk I, Clerk II, Typist, Clerical Specialist, Clerical Supervisor, and Office Manager I.

Among the civil service staff, there was a high level of consciousness about these titles, with an accompanying desire to advance through the Civil Service ranks. For example, if you hired in as a Clerk I and you were ambitious and bright, you would expect to get a Clerk II position within a year, and then move on to a Clerical Specialist within another year or two. After that came the supervisor and manager positions, but these sometimes seemed less attractive to people. Many chose to leave the Office when they have had enough as a Clerk II. The Office nurtured this desire for advancement by often abiding by a "promote from within" policy through the Clerical Specialist rank. Many of the people interviewed had advanced through the ranks.
During the pilot study in 1981, people from many areas of the office were interviewed. During the 1982 data collection, interviews were concentrated in the Operations area. The Director, Associate Director, and Systems Support staff also were interviewed.

The Operations Area was divided into four activities: Freshmen, Undergraduate, Professional, and Graduate/Foreign. As the names might indicate, each area was responsible for all aspects of application processing related to a specific type of applicant. Work groups had between three and ten full-time permanent staff members. The full-time positions were supplemented by "seasonal" part-time and temporary help as needed.

5.2 PHYSICAL ENVIRONMENT
The Admissions Office was located on the third and tenth floors of a semi-converted dormitory. The building was relatively new (built in the 1960's) but had a strange shape—it was octagonal with rooms, large and small, around the perimeter. The dormitory rooms (now converted to offices) were often small and walking through the building was like wandering through a maze. On several floors, the old dining rooms and lounges had been converted to open-landscape offices.
There were two open-landscape Admissions offices on the third floor. One (called the "open" area) was occupied by the administrative staff, counselors, and the phone center. The second area (the "closed" area) housed the Operations and Data Services staff. The physical separation, from the point of view of the clerks, helped to reinforce the elitism of the counselors. A few months before conversion, the manual files (manilla folders of applicants' materials) had been moved to the tenth floor. The administrative office for Systems Support also were on that floor.

There was a noticeable difference between the Admissions and Water open-landscape office. Part of this probably was due to the high ceilings and many windows (one whole wall was windows) in the Admissions office. This made the area much lighter and brighter, especially when compared to the semi-underground offices of Bookkeeping in the Division of Water.

The manual files had been purposefully moved seven floors away to discourage dependence on paper and encourage use of the system. While the use of the manual files had dwindled gradually during the months following implementation, clerks still spent time waiting for elevators.
5.3 **COMMUNICATION**

In the closed area, there seemed to be waves of communication and sound. For a half-hour, everyone would be working quietly at their desk or terminal. Then, one person would ask a question (not necessarily work-related), and a chain of responses and building of conversations would begin. This would last for about two to three minutes, and then all would be quiet again. This was a recurring pattern. Sometimes the noise waves would last longer. One conversation noted was a discussion of why sheep's wool didn't shrink when it was on the sheep.

In one area, known as the "problem" group, the communication and interaction had a different tone. People in that area would be more likely to talk loudly; the desks were crammed together so that noise travelled more easily. This group also had been placed "against the wall," away from the windows, next to the main door. The communication was much more constant. This was usually attributed to the personalities of the people in the group, although the physical arrangements seemed to promote such interaction.

Unlike Water, clerks in Admissions had to share terminals which were located on a neutral (not belonging to anyone) desk in the processing area. There also was a stand-up-only terminal for quick inquiries. Financial
restrictions mandated the limited number of terminals. This was viewed as a problem by many, because it affected both the pace and organization of work. It did cause a certain amount of physical mobility within the area, and probably promoted interaction between clerks whose desks were not next to one another.

There was a daily newsletter, *Communication Connect*, which circulated among all staff members. Anyone could put an article in the newsletter. It included notes on resignations, new hires, parties, system problems, reminders of deadlines, and other newsy notes. The newsletter was a symbol of management's desire to keep employees informed and involved.

Such efforts at open communication, however, were contrasted with a fairly strict observance of hierarchical channels of requests and approvals. For example, if a counselor had a request for a special project to be done by someone in the Grad/Foreign processing area, he or she had to request that service from the Assistant Director. Similarly, any significant problems that arose at the lower levels had to be reported by the clerk to the immediate supervisor, and by that supervisor to the Assistant Director, and by the Assistant Director to the Associate Director, on up the line. This hierarchy was, of course, eluded at
times, but if found out the person was usually subject to reprimands (or, as one supervisor described it, "I get what I call the teamwork lecture").

While there seemed to be a desire on the part of management to involve staff members, the realities of deadlines and work volume seemed to make participation difficult. One person described it as paying "lip service" to participative management. This paradox of participation is discussed again at the end of the chapter.

5.4 THE WORK

The Office of Admissions, a high-pressure, quantity-oriented business environment, was nestled within a more loosely-structured academic setting.

The primary tasks within the office were to:

1. respond to inquiries about Ohio State's programs and admissions process and policies
2. process all applications including:
   - verifying that all applications and records are complete
   - making admission decisions on those applicants who do not need to be reviewed by colleges or departments (e.g., freshmen applications)
• forwarding applications as necessary to departments
• evaluating previous coursework for transfer credits
• notifying applicants of application receipt, incomplete applications, rejection, and acceptance

3. recruit students
4. keep departments informed about the number and status of applicants
5. answer inquiries about the status of applications

Each year the office received around 100,000 phone calls, 600,000 pieces of mail, and 40,000 applications. While the degree of task complexity varied, task performance, in general, involved a strange combination of tedious paperwork, informed decision making, and detective work worthy of Sherlock Holmes at times.

For example, consider the processing of the 600,000 pieces of mail. The topics of correspondence ranged from general inquiries about the university, to questions about specific programs, to a transcript from a foreign university. Each piece of mail had to be opened and stamped with a received date—tedious work. Some had to be carefully read to determine what really was wanted or where to route the mail. This aspect demanded a fairly good knowledge of the Admissions Office and the University. Sometimes it took
weeks of repeated searching and detective work before transcripts and letters of reference from a myriad of sources were linked together to form a complete application. The typical flow of work was:

1. Data Services received the mail, figured out where it should go, and forwarded it to the proper Operations area.

2. Someone from the area sorted through the mail and forwarded it to the appropriate person or work-to-be-done pile.

3. The clerk assigned to a particular task performed the work.

4. With some types of applications, when the application was complete, it was sent on to a department (or "referred") for further action and decision.

5. The decision, when made, was posted on the computer system by the clerk.

In spite of having a sophisticated computer system, there were still many papers, complex paper flow, and many points at which papers could get lost.

While position descriptions varied between areas when the system was installed, the tasks within an area typically were divided as follows: Clerk I's coded applications; Clerk II's entered data (built applications); and Clerical Specialists evaluated previous educational experience and
way other supervisors talk—but even among ourselves, it's kind of a common joke, we sort of feel like our bosses—just imitate and copy.

5.6 THE COMPUTER SYSTEM BEGINS

The planning of the system began in 1976 and was actively pursued through the end of 1978. At that time, the Vice-President in charge of Admissions, who was an avid supporter of the idea, left the university. The project was essentially in a hold state until June 1980 when it was reviewed. The original ideas and purposes were trimmed down. The project received funding and an official go-ahead in September 1980. The programming was completed within nine months. The system made its "live" debut on June 29, 1981.

Two points stand out in the system's implementation saga. The first is the persistence and dedication of the designers. Many would have abandoned the idea after a period of over a year; everyone was ready to go and nothing could happen. Second is the very short time it took to program the system, probably due again in large part to the thoroughness of the specifications laid out by the system's designers.

The purpose of the on-line data-entry and information-retrieval system was to centralize information and make it
easily accessible to everyone. In the past, applications, transcripts, and other supporting documents for a student were kept in a manilla folder. This folder could be anywhere: in the file drawer for the processing area, with a counselor, in a pile waiting to be filed, or, most frequently, on someone's desk. When someone wanted to check on the status of an application, it could take minutes, hours, or days to find the folder. There was even a staff member designated as the official "file finder." A primary intent of the system was to eliminate such scurrying around, relieving the staff of the constant burden of not being able to find anything. In tandem was the idea that the on-line system could provide better service to applicants: if you called about your application, you would get a quick response about its status instead of waiting for days to find out that a transcript hadn't been received. In addition, it was believed that reports would aid departments in application processing and recruitment. In return for the increased efficiency in keeping track of and accessing information, however, everyone realized that there would be more work, since all that information in the files would have to be entered into the system.

The system included:

1. on-line data entry
2. on-line inquiry
3. on-line transaction generation
4. batch reporting

Tasks were performed through a series of 32 video display screens. Clerks entered a four-character command accompanied, when appropriate, by the applicant's social security number. If it was strictly an information-retrieval task, the system displayed a screen of information, and the clerk obtained the information needed or entered other commands to access screens with more detailed information. If the clerk was entering data, again he or she entered a four-character code, and the system displayed a formatted screen. Keys on the terminal were used to add information to or change information on the screen. Entering certain codes on the screen would generate mailing labels and letters.

5.7 REORGANIZATION

During the summer of 1980 as the requirements were being reviewed, it became apparent to the managers that the system as it was designed was not appropriate for the current organizational structure of the office. The office then was structured in an assembly line mode: input (open the mail, route the mail, make the folders); processing; evaluation of credits; and output (send out notices). If the system was to provide a centralized information service,
this fragmented style of information processing wouldn't work. Detailed discussion and analysis of the organization structure began in September 1980 and culminated with an extensive organizational change in February and March of 1981. A subsequent (although not necessarily consequent) event was the resignation of several managers during the late summer of 1981.

The reorganization was a change from the assembly line mode, where no one ever saw the application (or product) from start to finish, to a product-centered mode, with a small group being responsible for an application from start to finish. For example, the undergraduate area would receive all undergraduate applications, build (create) them on the system, update or maintain them as necessary, evaluate transfer credits, and communicate with departments and the applicants. In addition to meshing more closely with the centralized computer system, it was thought that this new approach would make individuals more responsible for their work since they could control the processing of an application.

The reorganization was significant in the processing areas. About two-thirds of the staff were assigned to new supervisors and managers. Work groups were split apart. The evaluation group, one of the most prestigious clerical
groups (only these people had Clerical Specialist titles),
was divided up and lumped into the other areas. The physi-
cal layout of office was changed. The manual files were
moved up seven stories to the 10th floor.

Anticipation of the change was traumatic for those in-
volved. The reorganization was announced and discussed in-
dividually with each of the affected employees. Anxieties
rose. When the change occurred, however, it wasn't too
bad. Some say that the reorganization went smoothly be-
cause it went quickly--about six weeks from the announce-
ment to implementation. A four-phase approach was used,
with boundaries and times of change clearly delineated, de-
scribed, and observed.

A secondary effect of the reorganization was that the
installation of the computer system seemed minor in compar-
ison. So much energy had been directed to the reorganiza-
tion by the staff that little was left for worrying about
or noticing changes brought about by the computer. The
on-line system just slipped into place.
5.8 **TRAINING**

When the Office received the go-ahead for the system in October 1980, people began considering the training program. A staff member was hired specifically to work on training, but she left in December. One of the members of the design and implementation teams picked up the responsibility for the training program. There were three parts to the pre-implementation training program:

1. The On-line Task Force was composed of the senior management staff and the design team. They learned the complete system, including concepts and the details; they considered the short-term and long-term effects of the system. This training took place in March and April.

2. The Select Staff Training Group began training in May and June. This group was composed of first-line managers from each of the newly reorganized groups. In addition, each group was to send another staff member through this training. This group was organized into three smaller groups. The small groups met twice each week for a couple of hours. The instruction was geared for tasks that were appropriate for each small group. On a third day, the small groups got together to discuss common questions and problems. "How to's" rather than concepts were emphasized.
3. The remainder of the staff received very general training: an overview presentation of the system; a tour of the computer center; movies and presentations on computers; and training on use of the video screen and keyboard. These events were held throughout the spring.

During this training, there was not easy access to the on-line system, so most of the activities involved simulations, on paper, of the various screens and maintenance functions. Overhead transparencies were used in some of the presentations.

On June 29, 1981, the "live" (i.e., real) system came up. The Office closed for two weeks to train staff members and prepare for the actual use of the system. At first people practiced building dummy applications on the system. Most learned quickly and were anxious to start working with real applications. In retrospect, most people forgot totally about this closed-down period.

The training workshops in the spring, demonstrations at terminals during June and early July, and on-the-job training were the main pre-implementation learning routes. Many of the people interviewed had been through the workshops and indicated that this was the most important training they received.
Documentation for daily use of the system was behind schedule. The User's Guide was not published until mid-October 1981. Consequently, people had to rely upon their peers, supervisors, managers, and the "select staff" for training, answering questions, and problem solving.

5.9 IMPLEMENTATION

The live system was made available to staff on June 29, 1981. The Office had an open house, complete with coffee and donuts. Staff members from the computer center were invited downstairs. Blue t-shirts emblazoned with a video terminal and "on-line conversion" were purchased and worn by many staff members. It was the visible culmination of over three years of work and planning.

Within a month, everyone was acknowledging how easy it was to find information. There was less scrambling around for files, less dread everytime the phone rang, and far less frustration.

There were problems, however. The original plan had been to still rely upon manual systems for autumn quarter and then switch completely to the automated system for applications for winter quarter 1982. The bulk of undergraduate and graduate applications would be processed for autumn, thus giving enough time to build the winter quarter
applications. In late spring came the announcement that no additional students would be admitted for summer and autumn quarters. Consequently, over 2000 undergraduate, graduate, and foreign admissions had to be delayed until winter quarter. That also meant that they had to be built on the system—a completely unanticipated workload. During the summer the first-line managers of the undergraduate and graduate areas resigned, adding to processing and turn-around problems.

In November 1981 these backlogs were still a major problem in the Office, detracting to a certain extent from the elation over the installation of the system. The backlog did not disappear quickly. By Winter 1982, the workload, particularly in Grad/Foreign, was overwhelming. Like Water, clerks were encouraged (many felt obligated) to work overtime in the evenings and on Saturday. The applications, however, kept piling in, right on the regular seasonal schedule. Mental and physical fatigue was a persistent problem—there appeared to be no end in sight. One clerk described her feelings:

I'd say staff's attitudes about their jobs really sank last winter and have been going up since. Why did they sink? Because we reached... we kept thinking as we got through—this is the grad/foreign area, I don't know about the other areas—we kept feeling like we were going to get through these special projects, and we were going to see some normalization. It never happened. Round about January, right after Christmas, the attitude, just exhaustion, really got bad. It didn't
start getting better probably until the beginning of summer.
Several of the supervisors and managers, however, coupled their description of this bad time with statements that surviving that period provided a sense of accomplishment and team work. Managers as well as clerks were entering data on the system. One manager noted, "I wouldn't want to live through it again, but it was a very satisfying experience."

The tide turned at different points in different areas, but between April and July, the backlog disappeared—the file drawers were finally empty. Admissions was "out of the conversion woods" one year after implementation, just as anticipated: "I guess they estimated when this whole thing started that it would take about a year before things could fall into the flow; it looks like they were about right."

During the summer of 1982, for the first time ever, the Office was close to meeting its once-considered-a-dream objective of processing an application within five days of receipt. Before the system, it generally had taken 20 to 30 days for an application to work its way through various paper processes. Now, with the computer system, it was close to five days. To the Director, this improvement was most visible in the reduced number of "complaint" phone
calls from distraught and angry applicants and departments. The system was working.

In October and November 1982, many of the clerks were bored. There wasn't enough work to do, and some tried to stretch out what little there was. One clerk noted that she was more tired from the boredom than she had been during the backlogs.

5.10 PERSONNEL CHANGES—FORMAL AND INFORMAL

From September through December 1982, several changes occurred at the supervisory, management, and clerical levels in Admissions. In August and September, two of the four operations area supervisors resigned. They had worked in those positions for less than a year; both areas had been "problem" areas during the previous year in terms of backlogs and various personality conflicts.

For several months, the Director and Associate Director had been attempting to reclassify the supervisor positions from civil service titles to Administrative and Professional titles of Manager. The senior managers agreed that they wanted to "attract candidates who have more formalized and experiential background in professional management—who are planners, organizers, analysts." The two remaining supervisors agreed with the proposed reclassification—they felt
they were doing professional management rather than supervisory work. The positions were reclassified in December 1982.

In November 1982, the Associate Director left. After some contemplation, it was decided to eliminate that position from the hierarchy—it was no longer necessary. This was not surprising. The main function of the position had been to ensure a smooth conversion to the on-line system; that task was completed. In addition, it was assumed that the Assistant Directors and newly-classified managers could take over many of the planning tasks performed by the Associate Director.

At an informal level, in some work groups there was evidence of progressive job enlargement and enrichment; the lines between jobs and classifications often were fuzzy. Working at a terminal for eight hours as a Clerk II building applications was agreed by many to be tedious, and attempts were made to vary the work. Similarly, people were finding that it was easier to look up the information on the system yourself rather than ask someone else. While this was not occurring in every job in every area, the pattern was evident.
5.11 POINTS OF ANALYSIS

5.11.1 Participative Design, Job Redesign, and Training

Again, to understand the relatively successfully experience in Admissions, it may help to examine the three implementation keys.

While the design team included programmers from University Systems (the data center), the core of work was done by employees in the Admissions Office, most of whom had worked their way up through the ranks. The Director of Admissions (the leader of the on-line project team) was completing his doctorate in Industrial and Systems Engineering. The design was thoughtfully conceived and developed, from the perspective of people who had worked with the data and in the processes. One clerk noted:

I'm really impressed--every day I get more and more impressed by what the people did that designed the system we got. . . . It's incredible the kind of information and the kind of cross-matching they've gotten put together. . . . the computer will come up with an error message for me, and I can't figure out what it is, but when I finally figure it out, I can't believe that the computer knew enough to spot it.

Months prior to implementation, again a great deal of thought and planning was put into job redesign. The On-line Task Force read books on job redesign and design of data-processing-related jobs. When the reorganization plan was drawn up, it was carefully explained to all the staff.
Fifteen months later, the group organization and the majority of jobs were the same. The one flaw was that they had not realized that everyone needed to use the system; this had not been part of the job redesign template.

Training and education prior to implementation had been thorough. Admissions still experienced the non-use of documentation, verbal folklore, and "patterns of independence" in using the system, but the understanding of the basics of the system had been adequate at implementation.

5.11.2 The Birth Metaphor

The quotations at the beginning of this chapter are about birth, the metaphor that perhaps best described the attitudes and feelings during the planning, arrival, and acceptance of Admission's on-line computer system. From the beginning, the system was seen as something that would dramatically alter the life of the office. People were told and knew that there would be changes—changes in jobs, changes in organizational structure, changes in the way work was done. People also knew there would be problems during the first year, but expected those problems to be part of a transition process.

A lot of that work has to do with the computer, because I would say that the system is getting to be more primary as the year goes on. Because more things are getting put on, more things are done by it, we're finding it more helpful, people are more willing to let the system do some of the
things that they used to do by hand. That was a real change I saw from when I worked, when I started--people didn't trust the system yet. They would also double check it by hand or getting the case, which has changed now.

Fifteen months after its birth, the system was an integral member of the working family:

What do you call the system?
I call the system the thing.
Do people say just I'll look that up. And it's just like a file or anything else?
Yes.
There's no animosity, is there?
Towards the system?
Yes.

None. We do have a couple of people who sit down at the CRT, and the system won't take something that they're trying to do, and they'll sit there and shout at it. But it's almost like listening to somebody complain to another worker.

Hidden in this metaphor of birth and the computer system as a new child, is the fact that the clerks are the parents--the ones in control.

5.11.3 The Theme of Development

The theme within Admissions which makes such a metaphor possible is one of development, a positive attitude towards change that assumes that the office, and people within the office, need to change and grow. Supervisors explained how they had matured and developed as managers during the
previous year. Senior management concurred. A job attitude survey administered in August 1982 showed that employees were dissatisfied with promotion and career opportunities; management wanted to know how they could correct this. Even in the worst of times, there was a sense that things would get better. As one person said, "Well, you know, we're always in the beginning of something new."

Clerks frequently were taking classes and completing degrees. There was a concern about learning. The turnover was frequent, but it was viewed as going on to better things. One manager aptly described the attitude he had, in the best of times, towards managing his staff: "I think when I think of how I like my job best, I think of being a manager whose employees are stars, and I'm managing their careers."

5.11.4 Paradoxes

Lest the picture of Admissions appear unrealistically rosy, some mention should be made of the paradox of a developmental attitude in a bureaucratic, civil service, high-pressure environment. A desire for staff and organizational development is hard to express, difficult to implement. At worst, staff members see a credibility gap, "lip service"—management says one thing and does another. In the interviews and observations, this paradox was less of a
sinister delusion than an underlying disjuncture between what people wanted and what could be done.

For example, it was during the 10th or 11th interview before a clerk mentioned that clerks who had to build applications on the system had to turn in daily reports of how many they had done. The supposed use of this figure was to be able to plan better, but the figures were not turned in anonymously.

On the one hand, people explained that the system was supposed to improve effectiveness—timely and personal processing of applications, not efficiency, yet all evaluative measures were simple quantitative measures of processing speed.

Within an office which talked of developing its staff, their were frozen careers. People aspiring to be managers were told they had not management experience or training; there was no where for them to go.

Staff, supervisors, and managers often were anxious to implement job enrichment strategies, yet the ominous threat of civil service mandates and potential grievances and complaints hung over their heads. They could have some job rotation and diversity, but always had to worry about what the official position description said.
Admissions had its share of personality and personnel problems, although most dissatisfaction seemed to center in one group or around one or two managers or supervisors. When the supervisor of one problem group explained to the group that I would be observing them, one clerk semi-jokingly said "What are we in the combat zone, and we need a neutral observer?".

What Admissions seemed to be experiencing were the growing pains of an office trying to shape itself as a developmental organization within a hierarchical, bureaucratic mold, a noble but perhaps impossible goal.
Chapter VI

POINTS OF COMPARISON

The overall implication is that, unlike many new technological developments which improve organizational efficiency, automated office systems have the potential to bring about profound changes in the nature of organizations.

(Olson & Lucas, 1982, p. 845)

In the previous two chapters, the stories of two offices implementing computer systems were told. In the Division of Water, the process was marked with confusion and conflict, but the clerks survived. There were also problems in the Office of Admissions, but levels of hostility toward the system seemed lower. The contrasting metaphors of battle and birth and differing themes of (mis)trust and development indicate that the two offices had, in some ways, fundamentally different experiences before, during, and after system implementation. While the sagas and symbols in the two offices differed markedly, a closer analysis revealed similarities between their experiences.

The purpose of this chapter is to examine, in more detail, the intersecting points of difference and similarity.
The previous two chapters presented a general overview of the experiences in the offices; this chapter gives a more detailed, but at times a seemingly more fragmented, picture of the two settings. At the beginning of Chapter III, the research process was likened to examining the multi-colored patterns produced by a whirling cone. The previous two chapters described the interior of two such cones. It is the intent of this chapter to attempt to discern similar color patterns between the cones and construct the color charts or palette from which they were formed. A main part of the chapter is devoted to describing categories constructed from the data. The chapter concludes with an attempt to describe how and in what ways computer systems may have an impact on clerks' working life.

6.1 MAJOR DIFFERENCES--A QUICK REVIEW

It may be obvious by now that Water and Admissions had very different approaches to and experiences in pre-implementation planning. The Division of Water, primarily due to a lack of in-house resources, appeared to have little participative design, job redesign, or training. The Office of Admissions invested time and staff in training, reorganization, and systems design. The comparative initial failure and success of the two systems supports the literature
which advocates the need for participative design, job re-
design, and training.

To the researcher, there was a very different climate or
tone in the settings, perhaps best described through the
contrast between the metaphors of battle and birth and the
themes of (mis)trust and development. One supports con-
flict, the other cooperation; one promotes oppression (of
workers over management as well as the traditional manage-
ment over workers), the other growth. It is not within the
scope of this study to provide reasons for these differing
tones, but they should be noted.

6.2 A STRUCTURE FOR COMPARISON

In spite of major differences at implementation time, 15
months after implementation, as people related past nd
present events, ideas, attitudes, and feelings, similari-
ties between the two settings surfaced.

The combined data from the two settings was analyzed and
organized into categories using Glaser's constant compara-
tive method. As mentioned in Chapter III, a computer-based
indexing system was used to help in constructing and recon-
structing category relationships. (See Appendix C for the
index.)
6.3 **COMPUTER TECHNOLOGY**

Computer technology is an abstract term and concept. In the context of the two offices, references to and discussions about computer technology tended to fall into six categories. While the categories were delineated somewhat by the physical boundaries, an important distinguishing characteristic was how close the users felt they were to the computer technology. The categories included:

- the system
- data processing people or group
- reports
- terminals
- response time
- down time

6.3.1 **The System**

When people talked about "the system," they referred to computer in its most complex and abstract form—the equipment, the programs, the reports, the "other." Variations on this term or concept included "the data system" and "the computer."
6.3.2 Data Processing People or Group

One step closer to humanity but still far removed from the clerks were the data processing people, group, or department—those who understood and controlled the system. In the Division of Water, these were the consultants, the City Data Center, or the Data Processing Coordinators within Water. In the Office of Admissions, this category included University Systems (a parallel to the City Data Center) and the Systems Support Staff (a close parallel in size and function to Water's two-person data system coordination group). In both offices, concern was expressed about the distance of these people and functions from everyday processing. Some believed this distance contributed to a sense of loss of control or lack of control over the system. As one supervisor in Water noted:

There are some things that cause us a lot of work. One thing in particular. When we suggested changing it, we were told it would be such a major change in programs that it wasn't feasible. That's probably true, but how can they just decide that without sitting down and figuring out how much time is really being spent? . . . I think a lot of our problems is it's not OUR computer, it's not OUR Data Center and we don't have a lot of control over them. If they don't want to listen to you . . .
6.3.3 Reports

Reports or printouts seemed to be mystical manifestations of the computer system, particularly when the computer system was new. Their size, number, and regularity of appearance reminded people that somewhere, out of sight, was a machine, working late at night, that generated huge amounts of printed material (which, of course, must be important). For the Bookkeeping Activity in Water, the truckload of reports delivered daily represented the computer. Again, the lack of personal interaction between the clerk and the computer should be noted.

6.3.4 Terminals

When people were relating their own relationship to the computer, they often talked about the terminal or "CRT" or "screen." In Water, the CRT was the part of the computer they were closest to—most clerks had a terminal on their desk. Narrowing the term down to "screen" implied even a closer relationship because references to screens usually meant entry, maintenance, and use of data, in which the clerk was personally involved.
6.3.5 Response Time

The term response time means the time that elapses between a clerk's sending a message to the computer and the computer's responding. In people's descriptions, it was a complex term because of its many connotations: the computer's controlling the pace of work; the interaction patterns between the person and the computer; the person's attitude that the computer must respond; and complex issues of control and autonomy.

In Water, the initial response time of the system was very poor (over 10 seconds for most screens, and minutes for some), yet the minutes of meetings and other documents during the initial months after installation never mentioned this. One person suggested that until the people knew the proper term to describe what they were experiencing, they could not explain or express their problems or their frustration. By October 1982, response time was one of the favorite terms used to describe computer system performance, even though timing the response time with a stop watch showed that it generally was good (three to seven seconds). This may indicate that when people were talking about response time, they were talking about more complex relationships and attitudes than simply elapsed time.
Occasionally people in Admissions mentioned poor response time. Monthly reports during the first year sometimes documented response time, particularly when Admissions was arguing or lobbying for improved resource allocation. Response time was not a rallying call in Admissions as it was in Water, though.

6.3.6 *Down Time*

When the system was unavailable, everything stopped. This was not a point managers mentioned, but clerks were well aware of it. Part of this selective ignorance seemed to arise from the underestimation, even in Admissions, of how everyone needed to use the system most of the time. Also, it usually makes managers and supervisors anxious when the staff has nothing to do. One Admissions clerk described the efforts to appear busy when the system was down. The Service Reps in Water complained about the fact that they were still expected to answer the phones when the system was down, yet their work was totally dependent on the computer system. These descriptions, perhaps more than any others, indicated the degree of dependency upon the computer and the degree to which the computer system had been integrated into jobs.
The categories which indicate the effects of computer technology on working life were not as easily delineated as those of computer technology. One of the main problems was that the categories were closely related to one another. For example, job enlargement was related to an increased sense of control over one's work which may be related to changing supervisory roles. With this understanding of the complexity involved, these are the categories that were determined:

- work load
- stress
- job content
  - enlargement
  - similarity between jobs
  - classification, position description
- control
  - by others
    computer
    closure and feedback
    supervisor's role
    hierarchy, organizational structure
evaluation
  - of one's own work
    responsibility
    autonomy, independence
- communications
  - inter-group
  - intra-group
  - computer-person

6.4.1 Work Load

During the first nine months, both offices experienced a dramatic increase in work load. In Water, the work load increase was attributed to a variety of factors: system failures, conversion errors, program errors, and some general confusion. In Admissions, the increase was due primarily to the policy to change admissions from autumn to winter, but also to the fact that a lot of information had to be entered into the computer. In both offices, managers had expected problems and increased work during conversion, but perhaps not to the degree that actually occurred.

6.4.2 Stress

During the "bad bill" phase in Water and the "backlog" phase in Admissions, people related being under a great deal of stress because there was so much work to be done. A clerk in Water related these feelings:

After three calls, sitting on the phone 25 minutes, and being told to ignore it, people begin to wonder. What is wrong with that place? What is wrong with those people? It was enough to make you cry. You hated to come to work. And they were always on us--answer these calls. We had thousands of more calls coming in because of
the problems being generated by the bills. It was so frustrating—you didn't have answers, you couldn't figure them out, you didn't know what to tell people, but they were constantly saying answer those phones as fast as you can. It was like I don't want to hear this anymore. I don't want to answer this phone anymore. I want it all just disappear. Everyone was short tempered.

A manager in Admissions described similar feelings among their staff:

That sense of being confronted with more than you can possibly handle. I'm not sure that I can say that that was the on-line system's fault. It was the way it was initiated; the initiation worked, so it must have been at least a good choice to do it that way, but for a year everybody had the feeling that there was just no end in sight. It didn't cause ... I don't think the turnover was any greater than before, but I know a lot of people were just very fatigued, and you can still see it.

6.4.3 Job

Perhaps the most noticeable changes in both settings were in people's jobs, particularly changes in tasks and task diversity.

6.4.3.1 Job Enlargement

A frequent comment in both settings was that clerks now had more and different things to do. The degree of task diversity varied between persons in a work group and between work groups. Generally, people did not feel their work was more difficult (cognitively), just that there were more and more different things to do.
6.4.3.2 Similarity between Jobs

A companion effect to job enlargement was an increasing similarity between jobs, both horizontally and vertically. In Bookkeeping, the Division was attempting to have most jobs placed in the same classification. In Admissions, there was sometimes an above ground and sometimes underground movement to cross-train and diversify. When one Clerk I position was vacant in Admissions, they chose not to fill it; the work demanded a Clerk II who could assume more varied duties. In Admissions, before the system, Clerical Specialists did only one task—evaluate previous educational experience. Before the system, all evaluators were Clerical Specialists and all Clerical Specialists were evaluators. One year later, evaluators were performing other clerical tasks, and others were sometimes evaluating. People who did not have evaluation as their primary responsibility had been placed in Clerical Specialist positions.

One manager in Admissions noted:

I think it's getting more of a complete mixture. That's been a goal, once things slowed down in October, especially, is cross-training in our area. I'm not making a distinction between Clerk II's and Clerical Specialists. Everybody's trying to learn everything as quickly as they can, and when they have time they document, so if it gets to the point again where we're so busy that we have to move people, they'll be ready.

In Water, the similarity was occurring between the Bookkeeping clerks and the Customer Services Reps. Both were
using the system, often in similar ways. Customer Services
Reps were doing some "bill research," once the domain of
the bookkeepers. Some Bookkeeping clerks said they had oc-
casional contacts with customers, just like the reps, so
what was the difference between the jobs?

6.4.3.3 Classifications

Job enlargement, job enrichment, and increasing similarity
between jobs go against the philosophy of rigid job classi-
fications and position descriptions. How much this became
an issue seemed to depend on the general attitude of the
staff towards their work and their relationship with their
supervisor. In Water, with the heavy presence of the uni-
on, this potentially could be more of a problem. In Ad-
missions, it was or wasn't, depending on the work group.
One person described her attitude toward the work group
that had refused to learn to do things outside their offi-
cial position description:

They cut their own throats when they first start-
ed doing that, and they hurt themselves a lot
too. When the system came up, and Clerk II's
were supposed to be building, and Clerical Spe-
cialists were supposed to do the evaluation--when
it came to offering or trying to take a Clerical
Specialist off doing evaluation and do some
building, evidently there was a fight, and they
said "It's not in my job classification." There-
fore they cut their own throat. They don't know
the system as well as if you were building. They
don't know to search in their areas. I mean it
really hurts you when you don't know where to
look on the computer to find out. What would
help you in solving the problem or taking care of
a case. That's where they cut their throats.
6.4.4 Control

Control is a complex category, but roughly outlined, it concerned the amount of control a person has over his or her everyday work. In addition to amount, an important distinguishing characteristic was where control resided—in others or oneself.

6.4.4.1 By Others

Control by Computer

When a computer system comes in, to a certain extent, the clerk relinquishes at least part of the control over his or her work, particularly in the pace of work, to the computer. The computer can make the work go more quickly or more slowly. Downtime can make work come to a standstill. An equipment or program error (as witnessed several times by Water) can dramatically alter the quantity of work to be done. One clerk in Water described this control as follows:

Well, we're working more now with ... before we could work around the computer. Now we're affected by it more. I think people feel like they're controlled by it. Their job is ... when the computer's down, we don't have that much that can be done without the computer. And I think that in the long run it'll be--I don't know what the word is I want to use--it'll prove to be more efficient, but in the first year it hasn't been. It seems like it's caused more work.
Closure and Feedback

Part of a sense of control over one's work comes from the feedback one gets and the knowledge that a task has been completed. In Admissions, a premise of the reorganization had been that it was a good idea for people to track an application from start to finish; the computer system would make this possible. One would get feedback from the system and also from one's work group, since the processing was contained, for the most part, in that group. Things would no longer disappear down the assembly line.

In Water, there were many complaints about a lack of closure and feedback, particularly from the Customer Services Reps. They felt that they would initiate a "bill research" or other process and never hear about it again, unless the customer called back. A rep related this story:

I had one account in particular. I talked to this lady for a month trying to resolve her mother's bill. After callbacks and inspections and meter tests and every nameable thing under the sun that indicated that there was nothing wrong with her meter and the water usage is right, we finally looked back over her history for three years, and there was an error in the meter readings, and she did not get credit for something she should of. I put an adjustment in the computer; this was shortly after we went onto the new system. Her daughter called me a couple of months later. Then we were two months behind in adjustments. I just told her we were behind, just disregard any final notices. Needless to say, she called back in because we had turned her off. Now there's an adjustment in the computer, and they're not supposed to turn off when there's an adjustment in there. She calls back in, her mother's water is off, they have not completed
the adjustment. I apologize profusely, I have her water turned back on. I have the adjustment copied, send it back down. Another two months later... by now, where are we? It was almost ten months, this entire process with this woman. I check the screen—No adjustment necessary. I've been assuring this woman for months; I was so upset. So I called a Bookkeeping supervisor. She spent a couple of days and showed me where an adjustment had been worked under the old system but never appeared on the new system anywhere. It just acted like she had never been given credit for it, but she had. Every rep you talk to has a similar story.

Altered Role of Supervisors

Supervisors' roles were changing. This was probably more evident in Admissions, where the change was planned as much as it was evolving. A typical supervisory role in an office is to keep track of people, paper, and the relationship between the two. Procedures for paper flow and processing are laid out, and the supervisor sees that those procedures are followed by people. When work is done on a computer system, gradually the need for tracking and controlling the paper processing disappears. The computer system checks for errors, the computer system automatically files, the computer system organizes data, the computer system generates reports, and the computer system can even keep track of how much work is being done. In its most extreme case, the computer system can assume the supervisor's role. The volume of data and processing mentioned earlier also affects how much the supervisor can do, altering his or her span of knowledge and information.
In the last chapter, it was mentioned that Admissions had reclassified the Operations supervisor titles to managers. New skills were being required of people responsible for controlling the daily work of clerks: planning (particularly long-range planning), organizing, and facilitating.

In Water, 15 months after installation, there were beginning to be inklings of such altered roles. One supervisor said that there simply was no way she could know everything or supervise every detail. She relied upon and encouraged clerks' solving their own problems or training and helping one another instead of running to the supervisor every time; this new philosophy was not being well received by some people.

Organizational Structure
Some mention should be made of organizational shifts that occurred before and after implementation. Recall that Admissions had totally reorganized the processing work groups, using a product-centered approach. This structure was still in place 15 months later. Some people were debating whether or not to pull out the data-entry function (in particular initial entry of an application) into a separate work group. This return to specialization might make the processing more efficient during one phase, but was being challenged on the basis of deviation from the
product-centered approach and principles of good job design (monotony of doing one thing all day). Fifteen months after implementation, the Associate Director resigned and was not replaced, resulting in a flatter organization. The functions and responsibilities of the Associate Director had or would be distributed to the newly-classified managers in the various areas.

In Water, there were similar rumblings. For example, the clerks in the Reports had gradually evolved a product-centered approach—each clerk was responsible for certain billing zones and handled all work related to that zone. The contemplated distribution of data entry to various activities also indicated a desire to group related functions together. A levelling of the bureaucracy was not in sight.

Evaluation

Measures of performance, at a division, activity, or personal level were a problem. The measures constantly used were quantitative—number of phones calls processed, number of applications built, time per phone call, total processing time for an application, and time spent on "breaks." Yet almost everyone agreed that these measures of efficiency could have little relation to the effectiveness of services being provided or the quality of work being done. A manager in Admissions described it as follows:
I look at the end of the day and see 13 applications built [the "ideal" is 50]. And there has to be some sort of measure of trust or understanding on my part that this person, based on the nature of the work they have to do, there's work they have to accomplish other than just building work. So I see that and it makes it hard. How do I evaluate that whole day's work, and if they've really spent their time effectively solving problems, or answering phone calls, all of those other things that are generally part of the job. Without a quantitative standard, it's real hard to know how someone's doing.

A clerk (from a different work group) in Admissions talked about the discrepancy between quantity and quality:

It's either a solid day at my desk or it's half a day running around doing problems, or if the day continues like it is today, it'll be a whole day at problem solving and the CRT. That causes some problems for me. Just this morning, I screamed "I don't know what to do." There's just so much to do. And we have to turn in this statistics report every day. So I told him there are days when I will have down there a good number of evaluations that I did, a good number of phone calls, and it will look like I just had a real good day, really hard working.

Well, I work hard every day, but it doesn't show on that sheet. And that causes me some problems. In our case, it's a disciplinary tool. I don't enjoy working under that. I find that conflicting. I'm there working hard, really trying to do a good job, conscientious responsible job, yet I have to turn around and turn in these stat sheets to prove what I've done today. And I said something to my supervisor about it this morning. And he said, "Do you feel like you're doing a good job?" I said, "Yes." He said, "Fine, I don't have any problem." I've got three written down, two phone calls, saw two students, and nothing else. Whadya do for the rest of the day? That's the way I feel it would be perceived.
6.4.4.2 By Oneself

Responsibility
Closely allied to closure and feedback is a sense of responsibility about one's work. This was a main reason for the reorganization in Admissions—if people had control over an application from start to finish, they would be more likely to feel responsible for the efficient processing and effective handling of that application. In Water, when Bookkeeping was reorganized, the Data Entry function was placed in a separate activity, serving as a centralized service for all Customer Services activities. It was the general opinion of management that this centralized service was not working—papers were getting lost, people were blaming one another. There was talk of decentralizing data entry, putting that function in each activity so that the activities would "be responsible for what they do."

Autonomy and Independence
In Human Factors in Office Automation, Galitz (1980) warned that you always have to remember that there are many different ways to do the same thing, particularly when you are using automated systems. This was certainly the case in both offices. For some people "doing things my own way" was partly rebellion, but for many, such "patterns of independence" had evolved as people figured out how to use the
computer system. The degree of increase or decrease in autonomy and independence since computer system installation was unknown. Descriptions of autonomy and independence did recur in conversations, however. This is a complex category and probably is affected by job design and management philosophy as much as computer technology. Computer systems may support or hinder (through inflexibility) autonomy and independence.

6.4.5 Communications

6.4.5.1 Inter-Group

When papers pass hands and phone calls are made and questions are asked between members of different work groups, they provide an opportunity for personal communication between those people. A central computer system provides universal access to information by anyone, without having to walk around the office or wander around the building. In Admissions, before the system, most permanent employees knew all the people in the processing areas. Fifteen months after installation, people said that they had never met someone or didn't even know the name of someone who worked 30 feet away, in another work group. In Water, both the Customer Services Reps and Bookkeeping said that before the system, they spent a lot of time talking to one another on the phone, solving problems. With the system in place,
those phone calls were rare; although information might be more accessible, they missed the opportunities for personal interaction.

Coupled with less personal, face-to-face communication, however, was the fact that the people were communicating via the computer. How one person entered something could affect someone else's work. For example, a date entered incorrectly by someone taking a phone call could generate an erroneous bill which might cause an angry call (to another rep) from that customer or a string of bill research problems for someone in Bookkeeping. In both offices, when a clerk entered some changes, he or she recorded his or her initials on the screen. When a clerks saw a mistake, they often knew who made it.

There were trends toward less inter-group communication. Where there had been communication before, clerks noted the absence. In some instances (for example the rivalry between the first and third floors in Water), less personal interaction may have contributed to more inter-group friction.

6.4.5.2 Intra-Group

In Admissions in groups where work was shared and the staff had been relatively stable, managers thought there were higher levels of group cohesiveness. It is speculation to
say that cohesiveness had any relation to the computer technology. Most people admitted to high levels, whether desirable or not, of peer interaction and peer training; again, this was not necessarily related to the computer system.

6.4.5.3 Computer-Person

The computer systems in the two offices were interactive—the clerk typed something on the keyboard and the computer responded, or the computer asked for information and the clerk responded. Either way, in many cases, a clerk spent a great deal of time communicating with the system, terminal, or screen. The nature of this communication varied. Some clerks worked quietly, others might occasionally talk to or yell at the terminal, and some clerks refused to communicate with it at all. Sometimes the system took on a personality of its own as anthropomorphism crept in. While I was observing in Water, the system came to a temporary halt—nothing was happening, or as the clerks phrased it, "the system's not moving." We were all sitting, waiting for things to get going again; reps had customers waiting on the line. In Water, the terminals would beep for various reasons. In the midst of quiet, one clerk thought she heard one of those beeps, and to the customer on the phone said, "Wait—I think I heard the computer move!"
In a quotation in Chapter V, one of the Admissions managers described how the system had almost become like another person in the office. What was not stated, however, was the nature of that person, an entity that provides immediate access to almost total information if you know how to ask the right questions. The computer system also provides feedback immediately for what you tell or give it. The computer system can be an oppressor, servant, peer, or tutor, depending on its and its user's characteristics.

6.5 THE IMPACT

So far, categories have been discussed for the two major entities of computer technology and clerks' working life. At this point, description and discussion moves to a higher level of inference, once removed but still grounded in the data. This section will present trends and patterns which may help to describe how computer technology may have an impact on working life. The trends which emerge from the data, and are, in part, supported by the literature include:

- decreasing radius of physical mobility and interaction
- increasing mental radius through access to information
- switching from concrete doing to abstract, conceptual thinking
- centering of work and working life in the work group and, ultimately, the individual

In November, towards the end of data collection, I was sitting on the periphery of a work group's area. There were occasional conversations, and every five minutes or so, there would be one or more people who would get up and move around, either to talk to someone, use a terminal, or find a form or folder. Since I was on the periphery of the work area, by turning my chair, I could observe adjacent work areas; the same sort of activity was occurring. After watching for about half an hour, I suddenly realized that people never moved out of their physical work-group area. There was movement and communication within the work group, but there seemed to be an invisible boundary or wall dividing one group from another. This observation supported what I had been hearing in interviews at both Water and Admissions—"I don't know the people in that group"; "We never get any feedback"; or "We never know what they're doing." Descriptions of "colonialism" and "parochialism" within groups made more sense. The emerging pattern was one of a decreased radius of physical mobility for work groups and individual clerks.

Literature on computers and work sometimes states that computers will cause alienation and isolation. When
observing and talking to people, I had not noted this theme, particularly on a person-to-person level. The decreasing of the physical radius did not seem to mean less social interaction, just less interaction with people outside of one's immediate radius of work and possibly more interaction within one's work group. If the work group got along, this could provide support for group cohesiveness. If there were "strong personalities" (a euphemism in both settings for intra-group conflict), the limited physical mobility could make conflicts worse. This interpretation is based on the assumption that people in work settings who need to socialize (this is not meant to be a perjorative term) will find a way to do so, in spite of rules, supervisors, peers, and computers.

Coupled with a decreasing physical radius may be an increasing mental radius, made possible through the computer's potential to provide and organize information. For example, prior to the computer system, the Customer Services Reps at Water had access to limited information on a customer's accounts. Many questions would be referred to Bookkeeping, or the rep would call downstairs for more information. When the new computer system was working properly, the reps had immediate access to much more information. For some, this was an opportunity for learning, for others it was an unnecessary burden. Several clerks in
Admissions related their desire to know more about the system and how to access information; they were ready to learn more.

A decreasing physical radius accompanied by an increasing mental radius relates closely to another trend—switching from concrete doing to abstract thinking. In both offices there were people who, by virtue of previous education or simply an ability to conceptualize processes, could "figure out what's happening behind the screens." These people, not necessarily supervisors, would provide information and training to others. Figuring out what was happening behind the screens required a knowledge of the data and an understanding of how data elements related to one another. One leap some people were said to be able to make was the relationship of data between screens as well as within a single screen. One person from Water described that transition from seeing things on paper and on terminals to being able to construct abstract relationships:

I guess after the first few months, I got to the point where I could even use the reports. We had reports coming over that we didn't know what to do with, and we didn't know where to look for information. I guess it took a few months before I got to that point. I say it took at least half a year to where if I saw a problem with the system, I could think in my mind what would have caused it. Before I knew there was a problem, but I couldn't determine what program caused it or what process caused it. I think now, after about six months, it's getting to where I can even figure out more where the problem is. Before I knew there was just one, and I didn't know how it
could be corrected, and how to even explain what the problem was.

Evans (1979) described the increasing emphasis on mental rather than physical processes as "the Computer Revolution, in which we move from the amplification of the muscles to the amplification of the power of the brain" (p. ii).

If, as Bell (1979) and many others would like to believe, there is a unifying concept for the categories and trends described above, it may be a gradual shift to centering work—job content, control, and communication in the context of this study—in work groups, and ultimately, in the individual worker. Yet, this is not a simple decentralization phenomenon, because although the work may center in the individual, computers at the same time, enable massive centralization of information. The simultaneous decentralization and centralization marks a radical shift in the way we think of work, workers, and organizations. The vocabulary, categories, and concepts we are accustomed to using may no longer fit.

6.6 OTHER FACTORS

Returning to current realities, and particularly the two offices studied, raises the issue that such trends were not occurring to the same degree in both offices. Computer technology was only one of several major factors
contributing to the press upon working life. The economy, organizational politics, management philosophy, and the personalities of management and staff often were mentioned as factors contributing to problems, successes, and failures.

In fact, when people were asked whether the introduction of the new computer system had caused problems, over and over again they said that the computer system may have caused some things to happen, but for the most part, it had aggravated or magnified pre-existing situations and relationships. The computer system supported or hindered a certain manager's approach. The computer system was a catalyst for reorganization that would have happened anyway. The computer system merely increased inter-group conflict that had always been there. In a similar vein, attempts to model how the computer system fit into an individual's or group or division's work and organization never seemed to work—the computer system had to be everywhere.

While the category structure proposed in this chapter helps to describe the experiences in the offices, when placed in a larger context of the organization, it fails to provide an explanatory framework—a single factor or node cannot be everywhere and affecting everything from every angle in a linear model.
A conceptual framework for fitting computer technology into working and organizational life may be that computers are not cells in the matrix or nodes in the network or elements in the model. Computers are, instead, the lines that define the cells, that link two nodes in a network, or connect two elements in a model.

One way to visualize this concept is to imagine a cluster of small objects, suspended in space. Any one object can be connected to one, two, or all of the others. The lines joining objects can be thin or thick, indicating the amount, quality, or importance of communication or connection between the two. The lines can be drawn in any direction—horizontally, vertically, diagonally, on the outside of the cluster, and into the center of the cluster. Computer systems may thicken lines are already there. For example, in a group that works well together, installing a computer system which provides shared information and work may strengthen those bonds or links. Where no links existed but should, that gap may be more noticeable. Tenuous links may dissolve. Perhaps most important, communications are not dependent upon paper, hierarchical lines of approval, phone calls, getting past private secretaries, or appointments. The possibilities for two-way links and linked clusters violate the rules of vertical communication which we have been told govern bureaucracies. Alternate pathways
of communication and governance have always been in place in organizations; computers may provide the ability to make these paths easier and more explicit.

6.7 SUMMARY

This chapter described some of the major differences and similarities in the experience of the Division of Water and the Office of Admissions when computer systems were installed. Inferences were drawn at three levels: categories constructed from the data; patterns and trends which threaded through the categories; and a model which attempted to provide a unifying structure for the categories, patterns, and trends.

Of the many categories and subcategories of working life, the most frequently mentioned or observed included: job enlargement; increasing similarity between jobs; jobs controlled by the computer; altered supervisory roles; difficulties in evaluating work; and less inter-group communication. The major trends or themes that ran through the categories were: a decreased radius of physical mobility; an increased radius of knowledge and information; a shift from physical doing to abstract thinking; and a gradual move towards centering of work in individuals and work groups. At the highest level of inference is the possibility that shared computer systems serve as the links in complex models rather than as discrete elements in the model.
Chapter VII

IMPLICATIONS FOR STAFF TRAINING AND DEVELOPMENT

Effective application of EDP [Electronic Data Processing] assumes simultaneous development of human beings, organizations and society.

(Groholt, 1980, p. 203)

This chapter begins with a review and further examination of the timing and types of training in the two offices. The next section describes the attitudes of clerks and managers toward the past, present, and future training possibilities. These training needs are then related to some of the major trends discussed in the preceding chapter, and some general training strategies are proposed. The chapter concludes with an examination of needs for and approaches to learning that may reach beyond the scope of training.

7.1 THE TRAINING PEOPLE HAD

Before projecting what should be, it may help to review what the staff in Water and Admissions described and thought about the training and education they received before, during, and after system implementation. To
structure the discussion, it may help to divide the training they received into five major categories:

- group instruction (classroom setting)
- on-the-job training (by a supervisor, manager, or trainer)
- peer training
- self-instruction
- use of printed documentation

In both offices, group instruction was the primary method used in pre-implementation training. In Water, staff members learned how to use the screens with "ideal" data; hands-on experience was included. In Admissions, as discussed in Chapter V, there were three levels of training: On-line Task Force, Select Staff, and general staff. Everyone received some general instruction on computers, an overview of the system, and some instruction (on paper) of how to use the screens. The Select Staff and Task Force received more detailed and comprehensive instruction; this was considered an intensive training program. Finally, the Task Force was responsible for also gaining an understanding, at a conceptual level, of the system.

At implementation time, the Admissions Office closed for two weeks for on-the-job training for the staff. The staff began by working with "dummy" data, then moved to working
with real applications. There was no time for such training at Water; instead the clerks jumped immediately into on-the-job training with real (and, if you will recall, sometimes bad) data.

The training pattern that evolved over the months following implementation was primarily peer training. If the supervisor was available, the clerk sometimes would go to him or her for help. In Admissions, the Select Staff also was supposed to fill this trainer role. As the months passed, however, and knowledge spread, clerks began to rely upon peers as much as supervisors for instruction and help. It was always easiest to ask the person sitting next to you for help. One Admissions manager described the peer training phenomenon:

The thing is, they sit together and they work together. Two girls sitting at the table together. One knows how to do something, a procedure, the other doesn't, because I haven't shown her yet, because maybe I didn't think she was ready to learn it. The one who doesn't know how to do it comes across that situation. And she says, "I don't know what to do with this." And the other girl goes, "Oh. I know how to do that." So she shows her how to do it. So that first person now has sort of a sketchy idea how to do it. Person three comes along, and this other person is doing it, and they don't know how to do it. It's like, "Oh, was I supposed to know how to do that? Oh no!" And they get real scared. What's even worse is that maybe two people show two other people how to do a function, and they don't show it the same way. So those two people, there are some conflicts...
Such ambiguity and flexibility in the way things were done was considered a problem, a nightmare, a threat, or a reality by various supervisors and managers. It was difficult to sort out was whether such diverse approaches made any difference. If people were entering data incorrectly, it was a problem. But if people were using different means to achieve the same end, who could say which was the best way of doing something?

One procedurally optimistic manager in Admissions believed that such diversity only occurred because of a lack of training:

> It depends on how much emphasis the office puts on training. If you give them formal training, they'll take it and they'll use it. But if you leave them to their own devices, they're all intelligent people, they're all going to come up with their own most efficient way.

A clerk in Water, however, had the opposite opinion. She said that even when she was given instructions on how to do a task, she would still do it her own way because that made the most sense to her.

Self-instruction through interaction at the terminal, in fact, was another prevalent method for learning in both settings. The computer provided immediate feedback, and, in some cases, assistance with what to try or enter next. Such self-instruction was greatly aided by good documentation or information on how to use the system.
In Admissions, the User's Guide (called "awesome" by one person) was published in October, three months after implementation. The User's Guide in Water was similarly large, but was divided into five volumes. In both offices, almost no one used the documentation. When I was observing, one rep in Water felt compelled to move her manuals—she couldn't stand the dust that had collected on them. So she dusted them off, never opened them, and put them back in the proper place. Admissions had included a "how to use the documentation" component in their training of new clerks, but the User's Guide still went unused for the most part. In some cases, clerks had copied portions of the manuals that they used most often and referred to them when necessary; this seemed to be the exception rather than the rule, however.

Admissions hired a person to be responsible for training people on the on-line system in December 1981, and several months later, training classes had been established for new clerks. The training had three components. If the clerk had never worked on a CRT before, he or she received keyboard or "operator" training from University Systems. The next component was for the trainer to sit down with one or two people and show them how to access commonly-used screens and perform some maintenance. A third component was a short class in how to use the Reference
Documentation. These classes generally were felt to be quite good and useful. In fact, some of the veteran staff were asking if they could attend as a refresher course.

7.2 THE TRAINING PEOPLE WANTED

Almost every person interviewed felt that more training and documentation was necessary—the type of training and documentation they thought was needed varied a lot.

In terms of pre-implementation training, there were many suggestions from the clerks in Water whose training had been short-circuited by early implementation. They felt they should have been trained on working with problem as well as ideal cases. One clerk in Bookkeeping felt that she really needed to learn was how the system related to her job (i.e., task- or job-specific training). Admissions had been able to accomplish this, for the most part, through the two weeks when the office was closed for on-the-job training.

The clerks did not express a strong need for any training or education that presented concepts of computing or a conceptual view of the system. A few people were interested in this approach, but many were not. Those interested tended to have previous experience with computing. One of the managers in Water had one of the widest educational
views. He felt that an organization should provide its staff with general education as well as training in computing. Those staff members who completed the course of study should end up with an Associate's Degree or certificate in data processing.

The most common request for training was one for cross-training, both within and outside of one's work group. From the managers' and supervisors' point of view in Admissions, cross-training could enable easier job rotation and cross coverage during busy times or when people quit. From the managers' and supervisors' point of view in Water, cross-training was a luxury in an environment with little turnover. From the clerks' point of view in both offices, cross-training was a means for alleviating boredom, increasing skills, and improving inter-group communication. One clerk in Water stated, "It would be easier and clearer for what we're doing if we understand what they're doing."

The cross-training cry was surprising in its frequency. What the clerks may have been asking for was not cross-training—understanding a job well enough to do it—but cross-visiting—meeting other people and getting a general idea of what they did and how they did things. If one relates this expressed need to the earlier theme of decreasing physical mobility, the meaning of the request takes on a different light.
An alternate approach to addressing the need for inter­
group communication was a suggestion for meetings which
would include people performing similar functions in dif­
ferent work groups so they could share information--another
form of peer training. Admissions had tried, for a few
months, to hold large meetings of the entire office. One
clerk noted this was an interesting idea, only everyone
talked and asked questions after the meeting instead of
when they were in it. During the meeting, as one person
noted, they sat there with glazed looks on their faces.
The meetings were abandoned after awhile.

Many of the supervisors and managers were interested in
writing procedures, to bypass if not end the tradition of
verbal lore within the offices. Neither office, however,
had access to word processing to make the documentation ef­
fort easier and more flexible; neither office was making
very much progress in this area.

It is difficult to know where to categorize one need
which recurred in conversations and on the employee sur­
veys--a desire for promotion. Many people felt they were
frozen in place, that opportunities were few, and that when
there was an opening, they were denied access to it (often
because of lack of education and experience). One clerk in
Water explained how when management positions were open,
they always wanted people with management experience and were unwilling to give unexperienced staff a chance. In Water, an employee survey indicated that in the activities studied, many staff members did not feel that people given promotions necessarily deserved them. On the surface, dissatisfaction with promotional possibilities may seem to have no relationship to computer systems. Recall, however, that one pattern occurring with the introduction of technology is job enlargement, similarity between jobs, and flatter organizations—all of which shorten vertically-oriented career paths.

Everyone felt a need for further learning, but there was no clear indication of what that learning should include or how to provide appropriate learning opportunities. One of the reasons for such ambiguity may be that, as mentioned in the previous chapter, computer systems may seem to be a separate entity, but they act as integrating force, melding with the rest of the work. One manager in admissions noted:

I think the thing that has surprised me most about the on-line system is the way people have learned to accept it as part of their jobs. It's no longer something external, it's no longer something anyone talks about a lot, as the CRT or as the system. Problems arise, but they're part of processing problems.

The blend between processing and the system was one of the sources of confusion about training. People, for the most
part, needed information about the system that was very specific to their jobs; there was no longer a clear line between the system and work. In both offices, this training domain was not really that of the officially designated data-processing trainer (only supposed to teach the system) or the clerical supervisor (supposed to teach the processing). Lines of domain and dominion were unclear.

Another reason for various responses about training might have been that people were trying to explain a need they had not encountered before—a need for gaining an understanding of abstract concepts or "the logic behind the screens." In discussing preliminary findings with the managers in Admissions, the trend of increased mental radius was described. One manager denied that was happening. He thought, in fact, that the clerks seemed less interested than he had been in learning more about the processing area. When asked to describe how he had learned about Admissions, his answer was simple—he had learned through detective work, trying to track down a form or a piece of paper, and talking with people in other areas to find out what happened to that paper. His vehicle for learning—tracking paper, crossing group boundaries, dealing with concrete things and real people (experiential learning) was no longer an opportunity offered to the clerks. People now had to learn many of those processes through mental
abstractions, a learning process that required, perhaps, very different skills on the part of the learner and very different training and support mechanisms from the manager and organization.

Threaded through the experiences and comments described above are again the patterns mentioned in the last chapter: decreasing physical radius; increasing mental radius; a change from concrete doing to abstract thinking; and a centering of work, including responsibility for learning, in the work group and the individual. These trends in the context of training may imply the following:

- Some cross-training may help to decrease feelings of distance and friction with other work groups.
- Since tasks and training needs are diverse, training should be individualized in content, pace, and timing as much as possible.
- Training should make some attempt to provide abstract or conceptual approaches, in addition to if not in place of, concrete experience.
- Documentation needs to be more usable and its use promoted.

Table 3 provides an attempt to relate various aspects of training, suggesting various content and delivery strategies that may be appropriate at different times surrounding implementation. The delivery strategies presented are:
• Documentation can be printed on available on-line, usually as a HELP function.

• Class refers to group instruction, usually in a classroom setting.

• Lab typically means a set of terminals that have been set aside for a structured "hands-on" experience.

• Tutor is an in-house consultant or trainer, available to anyone in the organization who needs help using the system. Supervisors or peers may assume this role on occasion.

• CBT is computer-based training, on-line.

The general scheme is that over time: 1) learning becomes more individualized; 2) the content becomes the learner's responsibility; and 3) repeated attempts are made to present concepts.
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**Pre-implementation**

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</tr>
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<tbody>
<tr>
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<td></td>
<td></td>
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<tr>
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<td>C</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>1-month</td>
<td>CT</td>
<td>CTD</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-week</td>
<td>I</td>
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**Implementation**

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**Post-implementation**

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<th>R</th>
<th>I</th>
<th>IT</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>R</td>
<td></td>
<td></td>
<td></td>
<td>IT</td>
</tr>
<tr>
<td>1-month</td>
<td>R</td>
<td>R</td>
<td>Q</td>
<td>Q</td>
<td></td>
</tr>
<tr>
<td>2-months</td>
<td>R</td>
<td>R</td>
<td>Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-months</td>
<td>CR</td>
<td>R</td>
<td>Q</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>yearly</td>
<td>CR</td>
<td>R</td>
<td>C</td>
<td>Q</td>
<td>I</td>
</tr>
</tbody>
</table>

**Codes for content**

- **C** = conceptual: system design, database relations
- **D** = demonstration
- **I** = instruction: how to perform a task or complete a process
- **Q** = questions of learners determine what is taught; may include any content approach
- **R** = reference: detailed described of specific item or process
- **T** = task- or job-specific information about system

**TABLE 3**

Training Strategies
7.3 **BEYOND TRAINING**

Training is not enough. Training addresses immediate needs, how to complete a given task. At best, it may propose alternatives; at worst, it is a single lock-step procedure. Remember again the trends—expanding information, complex relationships, and job enlargement. To a certain extent, flexible individualized training can fit into a dynamic environment, but there needs to be more. That additional structure and direction must come from other sources and other angles—education, staff development, organizational development, job redesign, organizational restructuring, and participative design.

All of these angles do not need to be discussed again. Job redesign has been mentioned repeatedly as being necessary for successful implementation of computer technology; the Admissions experience demonstrated this. Organizational restructuring at work group and larger levels also may be necessary. Again, Admissions had witnessed such restructuring. Participative design perhaps deserves one last example.

In Water, when someone entered a Service Request on a screen, he or she could request that the printer over in the Data Center print the request or that printing could be suppressed. Somewhere in the design, someone who would not
have to enter the code 50 or more times a day had come up with the codes the clerks had to enter:

Y meant do not print (i.e., Yes, I'm going to print this over at Water)

N meant print it (i.e., No, I'm not going to print this over at Water)

There was a small sign on the top of someone's terminal to remind her of this twisted logic which must have caused many training problems.

The one approach that has not been discussed yet is staff development. In the context of the literature and findings related to this study, staff development efforts might include the following:

- general education in computing
  
  If people are expected to participate in systems design, they must have an understanding of the design and computing process. In addition, such education may lay a conceptual foundation to support frequent changes to different applications and systems.

  - uses of computer systems; computer system components; how, at a very general level, computers work
  - systems analysis and design
  - database concepts and design
- debugging and other "detective" techniques
- word processing (access to word processing would make documentation efforts easier and more successful)
- data communications and networks

**human communications skills**

If work groups and tasks are continually shifting, it is important to be able to communicate easily and effectively with others. This can include verbal, written, and non-verbal communication.

**learning strategies**

If people will be expected to learn new tasks, concepts, and systems every day, every month, and every year, they need to understand and, if necessary, acquire new and effective approaches to learning.

**job design**

One of the secrets of retaining staff will be to provide enriched jobs as promotions and significant differences between jobs disappear. Tasks and environments also may fluctuate daily, monthly, and yearly, triggering frequent changes.

**counseling and facilitating skills**

This is particularly necessary for supervisors and managers cast in new roles.
In the first issue of a new journal, *Office: Technology and People*, Bjorn-Anderson (1982) stressed the need for adaptive systems controlled by knowledgable workers:

The key to reversing this [technology controlling people] is education: not training, but erudition. Instead of pursuing courses aimed at enabling the user to operate and appreciate a particular application, the main emphasis should be on enabling users to specify requirements, to critically evaluate and to constantly modify the applications themselves. Only in this way will it be possible to exploit the technology instead of being exploited by it. (p. 14)
Chapter VIII
CONCLUSIONS

As computers invade the workplace, they will alter the tasks of workers, the composition of work groups, the organization's functioning, the goals of unions, and the structure of society. If one follows many futurists, this alteration will not consist of superficial changes but in profound restructuring, physically and psychologically, in the way work is perceived and performed.

In the two offices studied, there were indications of some potentially profound shifts: job enlargement and enrichment; altered supervisory roles and functions; and shifts in organizational structure. In the Office of Admissions, which had invested resources, at multiple levels, in planning for its computer system, changes were more pronounced. In the Division of Water, there were ripples, but not waves, of these changes.
8.1 **Fittings**

Of the literature reviewed in Chapter II, the findings of this study most closely resemble those of Hepworth (1979) who described the shifts, over two to three years, of a British electric utility that installed a computer system. In that setting, the changes included: flattening of the organization (elimination of middle managers), altered roles of supervisors, job enlargement and enrichment, and, finally, centering of multi-purpose functions in a clerk's job.

Job centering, which is the process underlying job enlargement and enrichment, was, in the literature, an equivocal finding. There probably are two main reasons for equivocality: organizational context and the type of computing being performed.

First, control over one's work is a fundamental issue and is affected by many more factors than the computer system. The clerk's personality, the supervisor's personality, management philosophy, organizational philosophy, and the social and economic environment all have an impact on where and when decisions are made. When some findings were described to a colleague in the context of what might happen in his office, most notably decentralized word processing and clerical work, he disagreed vehemently because he
knew the personality of his office manager—she would never let any of those functions move out from under her control. The organizational context affects if and how quickly the process of decentralization may occur.

The second reason resides in the nature of the computing activity. There have been three main stages in office computing: non-interactive data processing, interactive data processing, and office automation. In the first, the clerk prepared data for input into the computer, according to fixed rules and procedures. Studies in this computing generation tended to find that computing made work more tedious, specialized, and formalized. In the 1970's, terminals communicating with large systems began to appear in offices, and with the terminals, some of the aspects of computing changed—clerks could interact, to a certain degree, with the system. There were still rules for input and pre-determined output, but, in the interim, the clerk could interact with the system. (This study falls into the latter interactive category.)

Katzan (1982) described the difference between these two data-processing models and office automation. In data processing, the person has control over the input, and is recipient of the output, but has no control over the processing—this is left to the DP (data-processing)
professionals. In office automation, the power over the processing (what, when, and how something is done) is assumed by the manager, professional staff member, secretary, or clerk. The clerk or non-DP staff member decides what a document will look like, how to arrange reports, and the calculations or analyses performed to produce those reports. It is a fundamental shift in where control over information and power over one's work resides. It is likely that office automation, more than data processing, will support the centering of work in individuals.

Within the popular literature on the impact of technology, Toffler (1980) touches upon some of the trends noted in this study. Toffler's thesis revolves around the de-massification of work and society, with a shifting downward and inward to the individual:

As the Third Wave cuts across our society, work grows less, not more, repetitive. It becomes less fragmented, with each person doing a somewhat larger, rather than smaller, task. Flextime and self-pacing replace the old need for mass synchronization of behavior. Workers are forced to cope with more frequent changes in their tasks, as well as a blinding succession of personnel transfers, product changes, and reorganizations.

What Third Wave employers increasingly need, therefore, are men and women who accept responsibility, who understand how their work dovetails with that of others, who can handle ever larger tasks, who adapt swiftly to changed circumstances, and who are sensitively tuned in to the people around them. (p. 385)
Such responsibility, adaptation, understanding, and sensitivity cannot take place without training and development at individual, organizational, and societal levels. Organizations that realize this perhaps yet unperceived need to provide personal and professional developmental opportunities for their staff at all levels and couple that development with considered changes in its philosophy, structure, and jobs, may be the organizations that survive the collapse of the Second Wave industrial society.

8.2 CENTERING

Many predictors of our future have described the decentralization process happening now and through to the next century, a splitting apart at personal, psychological, national, and world levels. At worst are the effects of loneliness, isolation, alienation, and conflict where those splintered lives are not reconstructed.

One approach to constructing life, and most particularly working life, is to see processes as centered in the individual or in the process itself (Jantsch, 1975). One looks to oneself, rather than the other, to define values, rewards, tasks, variety, and autonomy. The other (peers, supervisor, manager, organization, and computer) provide feedback, and one may adjust what one is doing, but the ultimate control resides in the individual (where it always has been).
People can care about their work. People, as the one supervisor in Water said, "want to do a good job." In office work, the ultimate impact of computer technology may be that it provides the means for self-centering and self-expression in work. Those means include: freeing people from repetitive manual tasks as much as possible; providing immediate feedback on work; enabling access to nearly total information; and supplying the potential for multiple methods of performing similar tasks.

These channels, however, cannot be opened without the belief in and support of management and the organization in the development of their staff:

But the nature of modern technology frees location from resource site and opens the way to alternative modes of achieving individuality and variety within a vastly increased output of goods. This is the promise—the fateful question is whether that promise will be realized. (Bell, 1979, p. 207)

8.3 FUTURE DIRECTIONS

8.3.1 For Clerks' Working Life

If one follows the centering theme through time, one can project the nature of clerical work in five or ten years. Computer technology can enhance communication and access to information. Computer technology can open new doors to knowledge. Acknowledging the presence and opening of these channels is the prerequisite to being able to control the
flow and redistribution of information and power. Control can be exercised through systems design, job redesign, organizational restructuring, and education. An organization that views its new computer system as "just another typewriter" can greatly underestimate the effects of technology, losing control before the onslaught of change even begins.

In an automated office where management and clerks were willing to undergo dramatic restructuring of work and jobs, one might expect to see large work groups, with diverse and constantly shifting tasks for members of those work groups. The supervisor's role would be very different, with an emphasis on facilitation rather than detailed direction of his or her staff. There would be far fewer middle managers. A clerk would be likely to stay in a work group for many years, but over time the work would change, gaining in complexity and difficulty as the clerk's skills and understanding increased. The job title would not change, but the work would. The type of change once possible only through promotion now would be possible within the widened and heightened scope of one's job.

That is an ideal case. Often, what might happen, particularly initially, would be a disjuncture between the communication and information supported by the computer
system, and the communication and information channels supported by the organization. It is highly likely that there would be much confusion as the gap widened, in some organizations, between "the way we have always done things" and the potential for "the way things could be done." To the outsider this gap may be obvious; to the insider it is often hidden.

For example, one colleague was describing how a word processor changed the jobs in his office. He would hand a manuscript to his secretary. She would type it. He would edit the document and indicate the changes. She would make them. He would review the document, make changes, and give it back to her again. They were fulfilling their traditional roles. Then the "boss" learned how to use the word processor. He now composed at the word processor during the evenings. When he reviewed documents, he also knew how to make the changes on the word processor. When the document came back and the changes weren't made correctly, he would be angry. It would upset him that so much time was lost in communicating what corrections should be made and the time it took to make those corrections (the secretary had other things to do). As he said, "We went round and round with that for about three or four months." One day, he realized that it was not necessary for the secretary to make the changes. In fact, it might be more
efficient for him to do his own editing on the word processor; it would save having to write everything down in detail, and the change would be made the way he wanted it. He said it took months, however, to recognize that a role readjustment (i.e., job redesign) was necessary. He was describing a three-person office. Imagine the confusion and conflict that might result in an office with thirty or three hundred employees if such role shifts are suppressed rather than acknowledged, directed, or supported.

8.3.2 For Research
The patterns and trends which emerged in this study that particularly bear further research are job enlargement and increasing autonomy and independence. They demand further study because: 1) they are recurring themes in the literature with equivocal results; and 2) they may express the possibly unifying concept of centering. Job enlargement and increasing autonomy are two findings that scholars expect to encounter, yet they seem to be two findings that elude detection.

Some statements to direct that research might be:
- The introduction of computer technology into an office supports job enlargement and enrichment if job redesign principles are also supported by the organization. Changes occur in the two or three years surrounding installation.
The introduction of computer technology into an office increases the amount of clerks' autonomy and independence, if such an increase is encouraged by the organization. Changes occur in the two or three years surrounding installation. Both statements include reference to the organizational context, a necessary component when examining complex systems. Both statements point to the importance of examination of long-term rather than short-term effects.

8.4 Final Summary
A comparative case study examined the effects of computer system installation in a large office on clerks' working life. The studies were conducted 15 months after the systems were installed. While both offices experienced change trauma during the first nine months, their subsequent experiences differed.

In the office that had included high levels of management and staff participation in systems design, had conducted thorough training programs, and had redesigned jobs and the organizational structure to go along with the new computer system, there generally was satisfaction with and acceptance of the system. In the office that had hired a consulting firm to design and implement the system, had not trained their staff, and had not redesigned jobs and the
organizational structure to a great extent, dissatisfaction with the system persisted 15 months after installation.

In spite of marked differences, several patterns of change in work were evident in both settings: increased job diversity; evolutionary job enlargement and enrichment; decreased inter-group contact; and altered supervisory and management roles. An overall pattern was a decreased physical radius but an increased mental radius for the clerks. Finally, informants repeatedly said that the computer system had been a catalyst for rather than a cause of change.

Implications for staff training and development include: a need for better documentation and training materials to promote self-paced learning; efforts at improving inter-group communications; a long-term need for educating as well as training clerical workers; and training and education to help supervisors and managers assume their new roles.

In future research, attention should be paid to the long-term effects of job enlargement, job enrichment, and increased autonomy and independence which continue to surface in the literature as important but equivocal findings.
Appendix A

RECORD OF RESEARCH EVENTS

A.1 DIVISION OF WATER

A.1.1 Titles of Persons Interviewed

Assistant Manager, Customer Services
Data Processing Coordinator
Supervisor, Accounts Receivable
Supervisor, Customer Relations
Water Consumer Transaction Coordinator
Assistant Superintendent
Assistant Supervisor (Reports), Accounts Receivable
Customer Services Representative
Customer Services Representative
Acting Assistant Supervisor (Data Entry), Accounts Receivable
Account Clerk II
Personnel Manager
Acting Assistant Supervisor (Public Office), Customer Relations
Acting Assistant Supervisor (Records), Accounts Receivable
Assistant Supervisor (Work Distribution), Accounts Receivable
Account Clerk I
Manager, Customer Services

Customer Services Representatives (12) while on phones

A.1.2 Documents Examined

Conceptual Design Document
User Documentation Manuals (5)
Accounts Receivable Procedures Manual
Minutes of User Management Meetings, 1981, 1982
Minutes of Steering Committee Meetings, 1981, 1982
Monthly Reports from Customer Relations, 1981, 1982
Problem Control Log
Reclassification documents for Accounts Receivable
(position descriptions)
Response Time Records (irregular)
Results of Employee "Job Satisfaction" Survey, August 1982
Report Distribution Logs and Procedures
A.2 OFFICE OF ADMISSIONS

A.2.1 Titles of People Interviewed

Associate Director
Assistant Director, Operations
Acting Manager, Grad/Foreign Processing
Manager, Professional Processing
Assistant Director, Support Services
Systems Support Specialist, Support Services
Manager, Freshmen Processing
Management Analyst, Operations
Clerical Specialist (Grad/Foreign)
Clerical Specialist (Undergraduate)
Director
Clerical Specialist (Grad/Foreign)
Clerk II (Grad/Foreign)
Clerical Specialist (Undergraduate)

A.2.2 Documents Examined

(The implementation process is documented in these)
Results of "Employee Attitude" survey, August 1982
Training materials (pre- and post-implementation)
A.3 TYPICAL INTERVIEW QUESTIONS

1. How long have you worked in this office? Where have you worked before?
2. What are your responsibilities and duties right now?
3. Have they changed at all since the computer system was installed?
4. How has the computer system affected your work?
5. When was the system installed?
6. What type of training did you have before the system was installed?
7. What type of training have you had since the system was installed?
8. What type of training do you need now?
9. What type of documentation is there? How and when do you use it?
10. What are people's general attitudes toward the system? Have they changed during the past year?
11. How well do you think you and others understand the system?
12. Do you think the system has made things better... or worse?
Appendix B

COMPUTING TECHNIQUES

The programs were written in SPITBOL, a character-string manipulation language closely resembling SNOBOL. The programs are relatively simply and could be translated fairly easily into another language such as BASIC, PASCAL, or PL/I. In several instances, an interactive text editor called WILBUR was used to manipulate the text to prepare it for processing. WILBUR is a powerful text editor but similar capabilities—global search and change, alignment of text—should be available through other editors and word processing systems.

B.1 REFORMAT

The following assumptions about the input data were made:

1. There is a separate file for each transcript.
2. The records are not line numbered.
3. Each record has a maximum of 48 characters.
4. A change in speaker is preceded by a record that has a "-" in the first position, followed by a two-character code of the person about to speak.

(See Chapter III for an example of the input data.)
The output from the program is a file of reformatted data, with each record containing tag or ID information.

The program follows.

```
INPUT('INPUT,'INFILE')
OUTPUT('DISKOUT,'OUTFILE')
&DUMP = 1
&STLIMIT = 1000000
-SPACE
TAGREAD
  TAGREC LEN(5) REM = 'TAGREC
  TAGREC LEN(2) = 'SITE
  LEN(2) = 'TYPE
  LEN(6) = 'DATE
  LEN(2) = 'INTERVIEWER
  LEN(2) = 'INTERVIEWEE
  LEN(2) = 'TAPENUMBER
  LEN(3) = 'DESCRIPTION
  LEFTTAG = 'SITE TYPE DATE INTERVIEWEE INTERVIEWER TAPENUMBER
-SPACE
&STRIM = 1
-SPACE
READ
  RECORD = INPUT :F(END)
  GT(SIZE(RECORD),48) :S(ERROR1)
  RECORD POS(0) "-" :F(DISKOUT)
  RECORD LEN(1) REM = 'DESCRIPTION
  DESCRIPTION = RPAD(DESCRIPT ION,3) : (READ)
-SPACE
DISKOUT
  DISKOUT = LEFTTAG DESCRIPTION ' ' RECORD : (READ)
-SPACE
ERROR1
  OUTPUT = "RECORDS ARE GREATER THAN 48 CHARACTERS."
  OUTPUT = "USE THE WYLBUR ALIGN COMMAND."
-SPACE
END
```
There were several steps to preparing the data for word frequency counts:

1. Change all characters to lower case (CHANGE.CASE, a WYLBUR EXEC command procedure).
2. Eliminate "filler words" (through the WYLBUR EXEC command procedure TRIMIT).
3. Prepare a list of all words.
4. Sort that list into alphabetical order.
5. Count how many times each word occurred.
6. Sort the frequency list into order by number of occurrences and print that list in addition to the alphabetical listing.

B.2.1 CHANGE.CASE

```
set uplow
cha 'A' to 'a' nolist
cha 'B' to 'b' nolist
cha 'C' to 'c' nolist
cha 'D' to 'd' nolist
cha 'E' to 'e' nolist
cha 'F' to 'f' nolist
cha 'G' to 'g' nolist
cha 'H' to 'h' nolist
cha 'I' to 'i' nolist
cha 'J' to 'j' nolist
cha 'K' to 'k' nolist
cha 'L' to 'l' nolist
cha 'M' to 'm' nolist
cha 'N' to 'n' nolist
cha 'O' to 'o' nolist
cha 'P' to 'p' nolist
cha 'Q' to 'q' nolist
cha 'R' to 'r' nolist
```
B.2.2 TRIMIT

comment
comment REMOVE PUNCTUATION
comment
change ' ' to ' ' nolist
change '? ' to ' ' nolist
change ': ' to ' ' nolist
change ' " ' to ' ' nolist
change ' | ' to ' ' nolist
change ' _ ' to ' ' nolist
change ' : ' to ' ' nolist
change ' " " ' to ' ' nolist
change ' " " ' to ' ' nolist
change ' " " ' to ' ' nolist
change ' " " ' to ' ' nolist
change ' " " ' to ' ' nolist
change ' " " ' to ' ' nolist

comment EXPAND CONTRACTIONS
comment
change "we" to ' have' nolist
change "m" to ' am' nolist
change "re" to ' are' nolist
change "n't" to ' not' nolist
change "'ll" to ' will' nolist
change "'d" to ' would' nolist
change "it's" to ' it is' nolist

comment ELIMINATE PILLER WORDS
comment
change ' and ' to ' ' nolist
change ' the ' to ' ' nolist
change ' you know' to ' ' nolist
change ' was ' to ' ' nolist
change ' is ' to ' ' nolist
change ' does ' to ' ' nolist
change ' this ' to ' ' nolist
change ' have ' to ' ' nolist
change ' this ' to ' ' nolist
change ' but ' to ' ' nolist
change ' did ' to ' ' nolist
change ' when ' to ' ' nolist
change ' thing ' to ' ' nolist
change something to nolist
change a to nolist
change at to nolist
change from to nolist
change to to nolist
change that to nolist
change those to nolist
change these to nolist
change get to nolist
change for to nolist
change on to nolist
change well to nolist
change than to nolist
change "s" to nolist
change in to nolist
change are to nolist
change an to nolist
change as to nolist
change be to nolist
change been to nolist
change can to nolist
change does to nolist
change each to nolist
change should to nolist
change would to nolist
change there to nolist
change into to nolist
change through to nolist
change of to nolist
change with to nolist
change so to nolist
change things to nolist
change over to nolist
change that to nolist
change about to nolist
change all to nolist
change some to nolist
change just to nolist
change lot to nolist
change really to nolist
change had to nolist
change were to nolist
change or to nolist
change other to nolist
change very to nolist
change has to nolist
change will to nolist
change be to nolist
change do to nolist
comment  ERASE BLANKS IN POSITION 21
comment
change ' ' 21/21 to '' nolist
change ' ' 21/21 to '' nolist
change ' ' 21/21 to '' nolist
change ' ' 21/21 to '' nolist
comment
comment  ERASE COMMON WORD ENDINGS
comment
change 's ' 21/72 to ' ' nolist
change 'ing ' to ' ' nolist
change 'ed ' 21/72 to ' ' nolist
comment
comment  LIST BLANK LINES
comment
list ' ' 21/25

B.2.2.1  Generate Word List

ESTLIMIT = 1000000
INPUT (.INPUT,'INPUT')
OUTPUT (.DISKOUT,'DISKOUT')
&STHHR = 1
NWORDS = 0
READ RECORD = TRIM(INPUT) ' ' :F(ENDING)
     RECORD LEN(16) LEN(2) SPEAKER LEN(2) REM . RECORD
     IDENT (SPEAKER,'fb') :S(READ)
SQUEEZE RECORD ' ' = ' ' :S(SQUEEZE)
CHOP RECORD BREAK(' ') . DISKOUT LEN(1) REM . RECORD :F(READ)
     NWORDS = NWORDS + 1 : (CHOP)
ENDING OUTPUT = NWORDS
END

B.2.2.2  Sort into Alphabetical Order

The IBM Sort/Merge package was used, with sort fields defined as:

SORT FIELDS=(1,20,CH,A)
B.2.2.3 Frequency Counting Program

```
INPUT('INPUT','INPUT'
OUTPUT('PRINT','PRINT')
OUTPUT('DISKOUT','DISKOUT'
&DUMP = 1
&STLIMIT = 1000000
&TRIM = 1

-SPACE
NWORDS = 1
OLD WORD = INPUT
COUNT = 1
READ WORD = INPUT :F(ENDIT)
NWORDS = NWORDS + 1
IDENT(WORD,OLD WORD) :F(WRITE)
COUNT = COUNT + 1 :(READ)
WRITE PRINT = " " RPAD(OLD WORD,25) LPAD(COUNT,5)
DISKOUT = RPAD(OLD WORD,25) LPAD(COUNT,5)
OLD WORD = WORD
COUNT = 1 : (READ)
ENDIT PRINT = " " RPAD(OLD WORD,25) COUNT
PRINT = " "
PRINT = " TOTAL WORDS = " NWORDS
END
```

B.2.3 List According to Frequency

In addition to listing the words in alphabetical order, the words were listed according to frequency of appearance.

Again, the SORT package was used:

```
SORT FIELDS=(26,5,CH,D,1,20,CH,A)
```

and then the sorted file printed:

```
INPUT('INPUT','IN'
OUTPUT('PRINT','PRINT')
&STLIMIT = 1000000
&MARGIN = DUPL(' ',10)
PRINTIT PRINT = MARGIN INPUT :S(PRINTIT)
END
```
B.3 INDEX

The construction of category indices was done through the University of Waterloo's version of SCRIPT, a text-formatting system for IBM and IBM-compatible computers. Indexing capabilities are found in many text formatting or word processing systems that run on medium and large-scale computers, but are less available on microcomputers.

An indexing rather than a database system was used because with most database systems you must define the categories in advance. In addition, you usually must indicate how many characters will be contained in fields and records, a potentially restricting and frustrating requirement. As database systems become more flexible, they may provide a better approach.
Appendix C

INTERVIEW TOPIC AND CATEGORY INDEX

The numbers in the index indicate line numbers in the transcripts. Line numbers from 1-5999 are from the Division of Water; line numbers 6000-13000 are from the Office of Admissions.
INTERVIEW TOPIC AND CATEGORY INDEX

abstract thinking ... 05142, 09869, 02896
attitude
  post-implementation ... 00881, 06612
    improving ... 00907, 03320, 03820, 04016, 05218,
                    05544, 00875
  post-implementation
    improving ... 01610
pre-implementation
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