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The Effect of an Integrated Library Computer System on Job Characteristics in Public Libraries

Richard J. Harris
Old Dominion University

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THE EFFECT OF AN INTEGRATED LIBRARY COMPUTER SYSTEM
ON JOB CHARACTERISTICS IN PUBLIC LIBRARIES
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A Dissertation submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
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OLD DOMINION UNIVERSITY
April, 1996

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THE EFFECT OF AN INTEGRATED LIBRARY COMPUTER SYSTEM ON JOB CHARACTERISTICS IN PUBLIC LIBRARIES

Richard J. Harris
Old Dominion University, 1996
Director: Dr. Roger Richman

This study investigated the effects of computerization with an integrated library system (ILS) on job characteristics in public libraries.

Two different but complementary research design components were used. One component consisted of a case study of the Norfolk (Virginia) Public Library, where an ILS was implemented between 1988 and 1995. The case study relied on data from interviews, archival sources, and questionnaires. The other component was a mail survey of public library workers across Virginia.

Case study interview data was analyzed by coding. Time series analysis was used to examine trends in budget and staffing. Pattern matching logic was used to identify a causal perspective. A chronological account of the ILS implementation project was developed from documentary and interview data. Questionnaire data was used to explore similarities and differences between the case study and the mail survey.

Library jobs were found to be affected by computerization with an ILS. An emergent causal perspective
was identified as the best explanatory approach to the data. Computerization interacted with concurrent downsizing of staff. The evidence supports a finding that the cost of computerizing resulted in staff reductions.

Mail survey data was analyzed using hierarchical multiple regression analysis. Five of 12 null hypotheses were rejected. Principal components analysis identified two separate components of an ILS: public service computing and backroom computing.

The multiple regression analyses indicated that different types of job characteristics, as identified by multidisciplinary job characteristics theory, were affected by different features of computerization. The most marked effect was that larger proportions of work time spent on the ILS were associated with more mechanistic job characteristics; this effect was moderated by job level. Perceptual/motor job characteristics were reduced by the presence of public service computing; this effect was moderated by professional status. Effects on motivational job characteristics were statistically significant but were so small that they lack practical significance.
Acknowledgements

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Finally, I am grateful to those staff of the Norfolk Public Library, former and present, who allowed me to do my research at their institution, and responded to my
interviews, as well as to all the people who responded to my mail survey.
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Chapter One

Introduction

Computerization in bureaucratic organizations changes the way that people work in these settings. These changes result from a complex interplay of technical and social factors, an interplay which varies from one institutional setting to another. Understanding the interaction of these factors in typical urban institutions is a central issue in the study of the effects of technology on urban society. Developing such an understanding requires an interdisciplinary perspective, and can make a contribution to each of the disciplines from which it draws support. This dissertation examines how computerization affects jobs in public libraries. In doing so it draws on the disciplines of organizational science, sociology of computing, public personnel management theory, and library science.

This research takes advantage of an opportunity for examining the effect of computerization with an integrated library system (ILS) on jobs in a traditionally designed library organization. Almost twenty years ago empirical research on library work arrangements found them to be predominantly structured in a bureaucratic manner. In
libraries oriented toward associations of professional librarians, such librarians used their authority to design jobs for all workers, professional and otherwise, in a prescribed bureaucratic manner. This effect was most marked in public libraries, although in some public libraries high levels of circulation of materials tended to diminish bureaucratic characteristics (Reeves, 1980).

Since this early research (Reeves, 1980) was conducted, library jobs have been transformed by the widespread use of computers. Furthermore, major advances in conceptualizing and measuring job characteristics have taken place. For these reasons, it now is appropriate to examine library jobs as impacted by computers, and conceptualized and measured using modern theory of job design.

The following discussion introduces the conceptual foundations of the research. It begins with a brief review of recent trends in the use of computers in libraries. Next, the nature of libraries as professionalized bureaucracies is discussed, followed by an examination of how job characteristics are measured. The introduction concludes by examining how the use of different causal perspectives can help understand how computers in libraries have affected job characteristics.

Computers and Libraries

Computer technology is flexible and has been implemented differently in different types of organizations.
(Majchrzak, Chang, Barfield, Eberts & Salvendy, 1987). This means that computer effects vary depending on their institutional settings; knowledge of computer effects in one setting will not necessarily apply in another. Public settings will differ from private ones, and industrial settings from service organizations. For example, computers will be used differently in banks than they are in auto manufacturers, and their use in libraries will differ from how police departments apply them. Because of this variability, the effects of computerization in a given type of organization is a question for empirical investigation.

During the 1980's, integrated library system (ILS) technology was adopted widely by public libraries in Virginia, a trend which continues. A 1992 Virginia State Library report indicates that 22 of 36 public libraries (61%) in the Hampton Roads, Richmond, and Northern Virginia areas had some degree of automation using an ILS. Fourteen of these twenty-two libraries had a full system; the other eight had partial systems (Roderick, 1992).

The saliency of ILS for this research derives from its pervasive effects across different library departments and functions. While libraries have computerized many functions at the departmental level, such as the transmission and receipt of interlibrary loan requests, such computerization directly affects only the department where it is located, and has minimal impacts elsewhere. In contrast, an ILS
affects all library departments, involving them in planning and implementation activities as well as in using the ILS for daily operations.

The topic of libraries and computers will be revisited in chapter two, where the literature of library computerization will be examined. In the following section, the professionalized and bureaucratic nature of libraries is introduced.

Libraries as Professionalized Bureaucracies

Reeves' (1980) research describes how library workers are stratified into two classes based on whether or not they have a graduate degree in library science. The library class structure consists of a two-level hierarchy of professional librarians and library support staff; it is superimposed on and congruent with a traditional bureaucratic organizational structure. Because the design of library jobs is defined as a component of professional expertise, the power to determine work arrangements lies in the hands of the professional librarians, who possess graduate degrees. The dynamics of power relations between professional and support staff prevent the topic of job design from being open for discussion or negotiation. Thus, the topic of how changes will be made in library jobs typically is omitted from consideration by librarians who report on library computerization (e.g. Mayo, 1982).
Complementing the bureaucratic and professional dimension of library organizational structure is another functional dimension which is based on whether or not a worker directly serves the public. Work at the library public service interface is exposed to environmental uncertainty to a greater extent than support service work (Chase & Tansik, 1983). Perrow (1967) suggests that such differences in exposure to uncertainty will result in differences in routineness between public service and support service jobs. Support service jobs can be expected to be more routine than are public service ones.

Public libraries are governmental organizations, and as such are subject to the various constraints which affect all government agencies. A constraint of this sort which affects public library jobs is the existence of civil service job classification systems (Ban, 1995; Shafritz, 1973). Any job changes must be acceptable in the context of the classification scheme.

The literature of the sociology of libraries will be reviewed further in chapter two. In the following section the topic of measurement of jobs is discussed, and the approach taken in this research is contrasted with earlier efforts.

**Measuring Jobs**

Reeves (1980) measured the nature of library jobs indirectly, by comparing groups of library workers
performing two different activities (selection of materials for purchase, and reference service to customers). He operationalized jobs by examining job descriptions, written records, and status differences in individual role expectations. Reeves' (1980) approach to measurement loses information when it aggregates individual level data into group scores, and lacks precision when it uses scores of single individuals to represent group characteristics.

This research takes a different approach. Since ILS has effects throughout the library it is reasonable to examine these effects on all library jobs, rather than those in a restricted set of functions. Further, both measurement and analysis are performed at the individual level, where job characteristics are experienced by workers. Conducting research solely at the individual level avoids potential biases which may occur in mixed-level research, where data from individual, group and organizational levels of analysis is combined (Rousseau, 1985).

During the 1980s, Campion and his colleagues (Campion, 1988, 1989; Campion & Berger, 1990; Campion, Kosiak & Langford, 1988; Campion & Stevens, 1989; Campion & Thayer, 1985, 1987) developed a multidisciplinary approach to measuring different job characteristics. Campion's approach allows the comparison of job characteristics which represent different disciplinary models of job design. The different models reflect different values: (a) mechanistic design
indicates an efficiency orientation; (b) motivational design indicates a psychological orientation; and (c) ergonomic design reflects a concern for matching the physical aspects of the workplace with human psychophysiological limitations. Using these models as outcome indicators, one can determine which job design model is most favored by computerization, as influenced by the professional and functional statuses of individual job holders.

The literature of job design will be examined in chapter two. In the following section the use of different causal models as a way of understanding the effects of computers on library jobs is discussed. 

Understanding ILS Effects on Library Jobs

Markus and Robey describe three different causal perspectives which seek to explain computer effects in organizations: (a) the technological imperative, which sees the computer system as the causal agent; (b) the organizational imperative, which sees the motives and acts of systems designers as the agent; and (c) the emergent perspective, in which a dynamic process of interaction between internal and external factors is the causal agent (Markus & Robey, 1988).

In analyzing the data, causal perspectives can be used by seeking to identify the perspective which best explains the effect of ILS on library jobs. This identification will result from understanding whether or not the implementors of
ILS had any explicit intentions relating to job design. The technological imperative is indicated as the applicable causal perspective if one discovers that ILS implementors lacked any interest in job design issues. In this case one can understand the effects of ILS as unmodified by human choice.

The organizational imperative causal perspective is indicated if one discovers that ILS implementors took a rational planning process approach to job design issues, and that the implementation encountered few or no unanticipated consequences. In this case, one can describe the values of the implementors of ILS in terms of the values which underlie the different job design models, and can infer that the job design outcomes correspond to the values and intentions of the implementors.

The emergent causal perspective is indicated if one discovers a complex implementation process, involving a variety of approaches to job design issues by implementors, a mixture of anticipated and unanticipated consequences, and an overlay of reactive adjustments to unanticipated factors during ILS implementation. In this case one can still attribute the values underlying the different job characteristics models to the implementors, but this attribution must be more cautious than it would be if the organizational imperative applied. The researcher will have to examine and to weigh all the evidence with the knowledge...
that only part of the effect of ILS can be attributed to human choice.

In addition, untrained individuals have been found to design jobs which score high on the mechanistic subscale of Campion's measurement instrument and low on the other subscales (Campion & Stevens, 1989). If the job characteristics outcome variables in this research differ from the pattern found by Campion and Stevens (1989), this would support the inference that the job characteristics associated with ILS result from intentional acts of library job designers.

Summary

This research revisits the question of how library jobs are structured. Since Reeves' (1980) research was conducted computers have become a major presence in libraries, and multidisciplinary measures of job characteristics have been developed. Data describing the effect of ILS on library job characteristics are gathered and analyzed. The effects of professional and functional status are included in this analysis. The identification of a causal perspective supports explanatory inferences.

In the chapters which follow, the literature is reviewed (Chapter Two), the research methodology described (Chapter Three), the data analyzed (Chapter Four), and the results of the analysis are discussed (Chapter Five). In the next chapter the relevant literature is reviewed and the
research is placed in the context of previous scholarly work.
Chapter Two

Literature from several disciplines have relevance for this research. The review which follows includes materials from: (a) librarianship, library computerization, and the sociology of libraries; (b) public personnel management; (c) computer effects on organizations; and (d) organizational science perspectives on technology, organizations, and jobs. In the first section of the review, literature relating to the public library setting is discussed.

The Public Library Setting

Library practitioners recognize four different types of libraries; school, academic, special, and public libraries. This four way typology is based on the different institutional settings that libraries inhabit. Thus, school libraries are found in K-12 educational settings, academic libraries in colleges and universities, special libraries often are situated in a business setting, and focus on a specific subject of central importance to their host organization, and public libraries are part of government. The similarities between libraries of different types stem from their common use of the theory and practice of librarianship. Their differences derive from their varied
institutional settings, and from the differing needs of the customers they serve in those settings.

Public libraries, due to their governmental setting, can be understood from the perspective of urban studies and public administration as well as from that of librarianship. Public libraries have to contend with the various legal and regulatory constraints that affect all public managers. The most important such constraint for this research is the personnel process associated with the use of civil service job classifications.

Jobs in libraries.

In reviewing literature relevant to the public library setting it is convenient to consider the literature specific to libraries separately from that which focuses on public management. In the following section the research of Reeves (1980), Damanpour and Evan (1984), and Lynch (1974) relating to libraries is reviewed.

Reeves' (1980) research focused on the effects of professionalism on work arrangements. Beginning in 1974, Reeves gathered data from 32 public, academic, and special libraries in the Canadian province of Alberta. Data was gathered on two types of library work: (a) reference work, which involves answering customer's questions; and (b) selection of materials to be purchased for the library collection. Reeves and his respondents recognized the existence of two congruent hierarchies in the research
sites: (a) the professional hierarchy, where professional status depended on a library worker's possession of a graduate professional degree; and (b) the organizational hierarchy, where the division of labor and means of coordination followed a bureaucratic, functional design. These two hierarchies were congruent in the sense that the higher and lower status roles in each hierarchy were occupied by the same individuals. Professional librarians, who occupied the higher status roles in the professional hierarchy, tended to be supervisors and administrators in the organizational hierarchy. Conversely, workers who were not professionals occupied the lower level roles of both hierarchies.

Reeves (1980) found that bureaucratic organizational structures in libraries derived from the application of professional norms rather than from an imperative of the host organization. Thus, managers of host organizations employed professional librarians to manage libraries because of their presumed expertise, and the professional librarians designed libraries in a bureaucratic and functional way because this was in accordance with the standards of their profession. Reeves found that these standards were produced by librarians' professional associations and were imbued in individual librarians during their professional education. Reeves also found that those library workers who were not professional librarians acknowledged the role differential
between themselves and the professionals and, therefore, deferred to the professionals' judgments.

The importance of Reeves (1980) work for the present research is threefold. First, it indicates that the responsibility for designing work arrangements in libraries belongs to professional librarian supervisors, and that this responsibility derives from their professional status rather than their supervisory status. Second, Reeves provides evidence for the assertion that libraries are typically bureaucratically structured. Finally, because Reeves' research is empirical, it rests on a firmer foundation than the descriptive and normative works found in the professional literature of librarianship (e.g. Webb, 1989).

Damanpour and Evan (1984) investigated the effect on library performance outcomes of differences in the adoption of two types of innovations from 1970 through 1982 in 85 public libraries in the Northeastern region of the United States. These researchers distinguished administrative innovations from technical ones; administrative innovations were defined as those innovations which originated in the social system of an organization, while technical innovations were defined as those which originated in the organizational technical system.

Damanpour and Evan (1984) found that, in general, libraries adopted more technical than administrative innovations. They also found that the association between
the rate of adoption of these innovation types was higher in higher performing libraries, and that higher rates of adoption of administrative innovations were associated with increased rates of adoption of technical innovations at a later time.

The significance of Damanpour and Evan's (1984) findings for the present research can be clarified by applying their distinction between administrative and technical innovations. The introduction of an ILS would exemplify a technical innovation, while changes in job characteristics would be an administrative innovation. Damanpour and Evan's (1984) research suggests that when libraries adopt ILS they will tend not to concurrently make deliberate changes in job characteristics. This research also supports a normative recommendation that libraries would improve their performance were they to adopt changes in job characteristics at the same time as they adopt ILS.

Lynch (1974) studied differences in technology in fifteen departments of three academic libraries. The main purpose of her research was to develop a valid and reliable measurement instrument for Perrow's (1967) technology construct. Perrow (1967) proposed that differences in technology in an organizational context could be analyzed by focusing on two dimensions: (a) the variability of the materials being processed; and (b) the degree to which exceptional cases in the production process are subject to
an analytical solution. When these two dimensions are combined in a two by two matrix they define a continuum between routine and non-routine work, where routine work involves materials with little variability, and exceptions which are analyzed easily, and non-routine work involves variable materials, and exceptions which cannot be solved analytically.

Lynch (1974) used factor analysis to demonstrate that her measurement scale validly represented Perrow's construct. She then proceeded to compare scores on this scale between the different library departments she had studied. The comparison showed that library departments could be distinguished by differences in their technology. The least routine technology was found in reference departments, and the most routine in circulation and searching departments.

The importance of Lynch's (1974) work for the present research is that it demonstrates that different types of library work can be compared using Perrow's distinction between routine and non-routine technologies. Furthermore, because Lynch (1984) has shown that the nature of different library jobs does vary according to their differing degrees of routineness, it is necessary to introduce a control for routineness into the analytical phase of the present research.
The research of Reeves (1980), Damanpour and Evan (1984), and Lynch (1974) provides empirical support for the assertions that:

(a) library jobs are designed by professional librarians as a function of their professional status;
(b) library work occurs in a bureaucratic setting;
(c) the implementation of ILS is likely to be done without any accompanying deliberate change in library jobs; and
(d) library jobs will differ as a function of their technological routineness. In the next section of this review the implications of public personnel management for public library jobs is discussed.

Jobs in public organizations.

Since the reform era of the later nineteenth century, jobs in government have been administered following a civil service model which severed personnel administration from agency management (Mosher, 1968). The intent of this separation was primarily to prevent the corruption associated with the spoils system. Jobs administered under civil service typically are controlled by a classification system which is intended to foster the principle of equal pay for equal work and to provide a rational basis for administering employee compensation (e.g. Suskin, 1977).

Classification systems administered through centralized personnel offices and civil service commissions constrain the ability of public agency managers to change job
characteristics. An agency manager seeking to change the characteristics of a job must rationalize the change in terms of two systems which have different goals and methods. These systems are the agency's own, which requires that jobs be designed so as to promote the agency's ability to meet its mission, and the personnel system, which requires that these same jobs also fit the requirements of the classification system.

Shafritz (1973), in an analysis of the federal classification system, pointed out that the system's roots lie in the scientific management theory of Frederick Taylor (Shafritz & Whitbeck, 1978). Thus, it is completely out of step with modern behavioral science based approaches to job design (e.g. Cummings & Huse, 1989). Shafritz' analysis is highly critical of the federal personnel classification system. Among the problems Shafritz identifies are: (a) the system is poorly adapted for handling administrative, professional, and technical workers; (b) it produces conflict in personnel agencies between the goal of serving agency management staffing needs, and the goal of policing these same agencies to prevent malfeasance by managers; (c) although intended as a control system to aid managers, the system actually hinders them by restricting managerial discretion and forcing waste of agency resources on circumventing the system; and
(d) the linkage between classification and pay systems, which involves the use of classification to determine pay in specific cases, invites manipulation of the classification system by managers who seek to reward their employees by increasing their pay, or to support bureaucratic empire building. Since pay is ultimately a budgetary matter, the ability of managers to manipulate pay through the classification system diminishes the effectiveness of budgetary control.

More than twenty years after Shafritz' (1973) critique of position classification in public personnel management, Ban (1995) published an analysis with comparable results. Shafritz' work focused on job classification, and was based on a synthesis of previously published research, while Ban's analysis was based on empirical research into the relations between agency managers and personnel agency staff in four different federal agencies. Ban noted that her findings confirmed Shafritz' critique and commented that the personnel system has been surprisingly resistant to change. Ban describes the use of job classification as a means of controlling costs. She acknowledges that managers still are abusing the job classification system to effect increases in employee pay and in agency budgets, as described by Shafritz, but points out that tight budgets put pressure on personnel workers to keep payroll costs low by avoiding even justifiable upward reclassifications of jobs.
The significance of the work of Ban (1995) and Shafritz (1973) for this research is fivefold:
(a) it indicates that personnel classification is supportive of a scientific management conceptualization of job design;
(b) as a corollary, it indicates that alternative approaches to the planned change of jobs would not fit well with the job classification system;
(c) the potential for confrontation between agency managers and civil service job classifiers is made clear;
(d) it points out that agency managers may have to invest resources in assuring that job classification outcomes meet their agency’s needs; and
(e) the implications of job classification for the payroll budget are clarified. The next section of this review will examine the literature of library computerization.

Computerization in Libraries

Libraries began computerizing their operations in the 1960s. The development of the MARC standard format for use in communicating catalog records began in 1965. In 1969 the Library of Congress began distributing catalog records in MARC format on magnetic tape, a milestone which initiated an era when libraries could share catalog records electronically (Salmon, 1975). Catalog records are the product of an extremely labor intensive activity, and the ability of libraries to use records created by other libraries reduced the labor intensiveness of the cataloging
activity. The widespread availability of catalog records in electronic form spurred the development of a variety of library computer systems. While most early efforts focused on single library functions, such as circulating materials to customers, by the early 1980s integrated systems had emerged as the computerized library system of choice (Cortez & Smorch, 1993). These computer systems were able to manage efficiently most core library functions by using centralized databases of library materials and customers. These centralized databases were available to all the different functional computer programs, such as circulation, cataloging, periodicals, purchasing, and the library catalog itself.

The literature of library automation which has been produced by library practitioners has little relevance for this research. This literature features accounts of the selection and implementation of computer systems. Where this literature concerns the effects of computer systems it focuses, for the most part, on how the resulting changes in service affect library users. This focus on how library computerization affects customers is consistent with the service orientation of librarianship. However, it does mean that the bulk of the library science literature relating to computerization has little relevance for this research.
Johnson (1991) comments that:

Libraries have been slow to plan and implement significant organizational changes as a result of automation . . . . Little attention has been paid to the organizational consequences of automation because its primary objective has been improved patron service. Libraries have tended to look outward rather than inward as they implement automation. The result is that few organizational models for libraries in the 1990s and beyond exist. (p. 154)

Examples of reports from the library literature which do not consider how computerization changes jobs from the perspective of the worker are numerous (e.g., Bowden & Swanner, 1985; Kelly, Halbrook, Igielnik, & Rueby, 1985; Mayo, 1982; Nagle, 1988). Publications which do consider the effects that computers have on library workers are summarized below. Some of these, such as Allen (1991), and Glogoff and Flynn (1987, 1990) are descriptive and normative. Others, such as Harris (1992) and Moore (1987) are theoretical in nature. Finally there are several empirical studies, by Hahn, Gray, and Langton (1987), Johnson (1991), Luquire (1983), and Rhine (1986).

Allen (1991) examines how implementation of an ILS at the University of Oregon affected the relationship between library units which directly serve the public and other units which fill a supporting role. She makes suggestions
for techniques which will improve interunit communication and thus overcome the barriers between them.

Glogoff and Flynn (1987, 1990) summarize lessons relevant for in-house training for ILS use based on their experience at the University of Delaware. They emphasize the importance of the training effort and describe the pitfalls which can be expected. Use of a theoretical framework such as adult learning theory is recommended, as is an analytic approach to aligning the training plan with the library’s strategic plan.

Harris (1992) discusses the potential that library computerization will deskill and deprofessionalize librarians. Taking a perspective based in feminist critical theory and the sociology of professions, she contends that core professional skills are being absorbed by computers, and that the knowledge and skills that are not so absorbed will be insufficient to support the professional status of librarianship. Using the example of cataloging, she shows how automation has the potential to throw professionals out of work, while the work they once did is handed over to lower paid nonprofessional staff.

Moore (1987) synthesized the literature of computerization of organizations and related this to the computerization of libraries. She suggests that computers have not been found to have a deterministic impact in organizations generally and recommends that librarians
conceptualize the effects of computers as contingent on the social contexts of their libraries.

Hahn, Gray and Langton (1987) surveyed academic and public librarians in the United States, asking questions which related to the management of technological change. Although no data were presented, respondents reported a variety of changes related to organizational structure, human resources, and the need for institutional support. Respondents reported that the introduction of new technologies did change jobs. This change was seen as a consequence of process changes, but the responses provided no consensus relating to the nature of these changes.

Johnson (1991) surveyed the chief administrators of support services units in 119 Association of Research Libraries (ARL) libraries and received 54 usable responses. The scope of the survey was broad, encompassing the association between computerization and organizational change. Findings relevant to this research include: (a) a tendency for lower level staff jobs to be upgraded as computers absorbed the routine work formerly done by these individuals; and (b) a parallel tendency for higher level jobs to also become more complex, as the less complex tasks formerly performed at the higher levels were reassigned to lower level staff. In addition, the presence of more advanced technologies than were present previously has a tendency to further complicate decision making. This
tendency is present at all staff levels, as lower level staff have more responsibility for making decisions than was formerly the case.

Luquire (1983) surveyed support service professionals in 23 ARL libraries which were using an external computerized service to provide catalog records (OCLC). The research found that respondent acceptance of the OCLC service was affected by factors such as library management style, respondent rank, size of library, extent of preparation by the library for implementation of the OCLC service, individual demographics, and the length of use of the OCLC service.

Rhine (1986) surveyed nine support service staff at the University of Florida Health Sciences Library regarding their reactions to the introduction of an ILS. Respondents noted positive reactions toward changes in workload, scheduling, and procedures, and negative reactions to the work setting.

The literature of library computerization reviewed here raises several issues of importance for the present research. Johnson (1991) confirms that librarians have paid little attention to planned organizational change as they have computerized. The importance of good internal communication (Allen, 1991) and strong staff training programs (Glogoff & Flynn, 1987, 1990) is emphasized. Empirical research has shown that:
(a) library computerization has affected library jobs (Hahn, Gray & Langton, 1987);
(b) worker acceptance of computerization is influenced by a variety of factors (Luquire, 1983);
(c) while computerization has been accepted, and not rejected, by library workers, concerns over negative effects of the physical nature of the workplace have been an issue (Rhine, 1986); and
(d) the absorption of routine work by the computer has led to a general upgrading of job responsibilities, where lower level staff assume duties which were performed previously by higher level workers, who in turn assume new and more complex tasks (Johnson, 1991).

Theoreticians have called on librarians to recognize that contexts are determining factors in computerization outcomes, rather than the computer itself (Moore, 1987), and that the absorption of duties by computers has the potential to deprofessionalize librarianship through deskilling (Harris, 1992). In the section which follows the literature of computerization and organizations is reviewed.

Computerization and Organizations

Research has been conducted on the organizational effects of computers from a variety of disciplinary perspectives, including "organizational theory, management science, sociology, and computer science" (Markus & Robey, 1988, p. 583). The resulting literature is fragmented and
inconclusive. Researchers have adopted "conflicting and unclear definitions and measures" (p. 583), and their work often is put at risk by the practice of mixing units and levels of analysis (Markus & Robey, 1988). The fact that computer technology is highly changeable makes the timely development of socially meaningful constructs and measures difficult, and hinders the cumulation of knowledge (Zmud & Boynton, 1991). This state of relative confusion in the literature has led to the development of several typologies which attempt to organize the literature by dividing it into theoretically significant categories. In the following section these typologies are reviewed.

**Typologies.**

Hirschheim (1985) suggests that existing typologies from organizational science be adopted and applied to the study of office automation. Pfeffer (1982) classifies different organizational theories on two dimensions, the level of analysis (micro versus macro), and the perspective on action (rational actor, situational control, or emergent). Astley and Van de Ven (1983) take a similar approach to Pfeffer, but they simplify the perspective on action dimension to a contrast between deterministic versus voluntaristic assumptions. This perspective allows them to classify all organizational theories into four categories: (a) natural selection; (b) collective action;
(c) system-structural; and
(d) strategic choice.

Burrell and Morgan (1979) analyze sociological theories using the dimensions of assumptions about society (regulation versus radical change), and assumptions about social science (subjective versus objective). This allows Burrell and Morgan to classify all sociological theories into four categories:
(a) radical humanist;
(b) radical structuralist;
(c) interpretivist; and
(d) functionalist.

Hirschheim develops his own typology of six different views of office automation, based on a contrast between analytical and interpretive perspectives, a contrast which is similar to Burrell and Morgan’s contrast of objective and subjective assumptions about social science. Hirschheim then attempts to map his office automation typology on to the typologies of Pfeffer, Astley and Van de Ven, and Burrell and Morgan, but this is more confusing than successful.

Kling (1980) contrasts systems rationalism, which is characterized by a focus on the positive benefits of computers, with segmented institutionalism, which focuses on the consequences of computers, both positive and negative.
Kling examines such features of theories as their views of:
(a) the function of technology;
(b) the characteristics of a good technology;
(c) the dynamics of technology diffusion;
(d) the ideology of the workplace; and
(e) social structure, as well as their central organizing concepts. Using these features he is able to classify theories of computer impacts into six categories. Three of these categories, rational, structural, and human relations, fall under the general heading of systems rationalism. The other three categories, interactionist, organizational politics, and class politics, fall under the segmented institutionalism heading.

Mowshowitz (1981) identifies five general theoretical positions, but does this without using the dimensional contrast technique used by the other typologists reviewed. Mowshowitz subdivides several of his five categories. The five categories are technicism, progressivism, elitism, pluralism, and radical criticism. Technicism is an expression of faith in the computer as force for progress. Extreme technicism, characterized by an insistence on formal institutional control of computer based development, is subdivided into statism, which supports government initiatives to stimulate economic growth, and corporatism, which supports cooperative efforts between management and labor in the workplace. Progressivism shares the technicist
faith in the benefits of computing, but also has reservations based on a knowledge of the imperfection of human nature and institutions. Progressivists are subdivided into reformists, who wish to promote computer use by removing technical or social obstacles, and pragmatists, who think that careful design of institutional settings is necessary in order for computer use to be optimally beneficial. Elitists share the technicist faith in progress, but believe that strong social controls are needed. Elitists are subdivided into technical and managerial classes, based on whether the elite is identified as computer specialists or managers. Pluralism is named by analogy with political pluralism and holds that the different groups affected by computers must be represented effectively in the policy process if positive outcomes are to occur. Much of the research on public sector computing is found here. Radical criticism attempts to understand the underlying causes of the social issues and problems associated with computer use. Radical critics are subdivided into two classes, determinists and devolutionists. Determinists hold that outcomes are determined by massive institutions, making the actions of individuals irrelevant, while devolutionists believe that systems have become so complex that humans have lost control over them.
Markus and Robey (1988) follow Hirschheim's notion that typologies developed in disciplines such as organizational behavior can be useful in studying computerization. Their typology integrates three factors, causal agency, logical structure, and level of analysis. The typology of Markus and Robey can be understood as an integration of Pfeffer's (1982) typology with a conceptualization of logical structure developed by Mohr (1982). Mohr distinguishes between variance theories and process theories. In variance theories the role of time is static, causes are necessary and sufficient conditions for their inevitable outcomes, and variation in causes produces variation in outcomes. In contrast, process theories see time as the dynamic background against which events unfold, causes are sequences of necessary conditions combined with the effects of chance, and there is no necessary link between variation in causes and in effects.

Markus and Robey (1988) proceed to combine Mohr's variance/process distinction with Pfeffer's (1982) analytical dimensions of perspective on action and level of analysis. Markus and Robey use different terminology than Pfeffer. Pfeffer's "perspectives on action" is Markus and Robey's "causal agency". Likewise, Pfeffer's "situational control" and "rational actor" perspectives become Markus and Robey's "technological imperative" and "organizational imperative". The name of Pfeffer's third perspective on
action, "emergent", remains unchanged in Markus and Robey's typology. The technological imperative sees computers as an external force which determines organizational outcomes. The organizational imperative, in contrast, sees organizational outcomes as resulting from the rational choices of organizational members. The contrast between these two imperatives is analogous to Astley and Van de Ven's (1983) contrast between the structural-functionalist and the strategic choice perspectives. The emergent perspective, as its name suggests, sees organizational outcomes as emerging unpredictably from the social context of computing.

The final element of Markus and Robey's (1988) typology is level of analysis. This factor is important because it is associated with the need for researchers to avoid problems of inference and discipline derived bias. Inference problems can occur when definitions or data exist at one level of analysis while theory relates to another level. When research combines several levels of analysis particular care is necessary. Discipline derived bias stems from disciplinary preferences for macro or micro level theories of causality.

Goodman, Griffith and Fenner (1990) criticize the typologies of Hirschheim, Kling, and Markus and Robey. While acknowledging their usefulness for literature synthesis, and for understanding the differences between
various theoretical approaches, they believe these typologies are unable to generate new research paradigms or predictions. It is true that the typologies of Kling (1980), Mowshowitz (1981) and Hirschheim (1985) are unwieldy when applied to new research initiatives. However, the typology of Markus and Robey (1988) has provided a basis for organizing the present research. The multimethod research design of this research, described in chapter three, parallels variance/process logical structure by including both quantitative and qualitative research methods. Furthermore, the causal agency distinctions between technological and organizational imperatives and the emergent perspective are the basis for analysis in chapters four and five.

This examination of several typologies began with the assertion that the literature of computers and organizations was somewhat inconclusive and fragmented. In the following section reviews and empirical studies from this literature are examined, with particular attention to those which focus on the relationship between computers and jobs.

**Reviews and empirical studies.**

Kling (1978) surveyed 1200 managers, analysts and clerks in 42 municipal governments to determine the effect that computing had on the characteristics of their jobs. Job characteristics were measured using a modification of the Job Diagnostic Survey (Hackman & Oldham, 1980). The
characteristics measured by this instrument are discussed in the section of this review relating to job design. Kling found that computing was not a dominant force in the work life of his subjects, and thus had only a small but positive effect on their jobs. There was evidence for job enlargement, increased task significance, and increased time pressure for many workers, but not for all. Computing in the workplace was associated with low levels of turmoil. Managers were more affected by computers than were clerks.

Kling (Kling & Scacchi, 1982; Kling, 1987), in two literature reviews, distinguished discrete entity models of computing effects from web models. Discrete entity models have the following characteristics:
(a) computing is conceptualized as a single technology with known benefits and costs, and which is also socially neutral;
(b) infrastructure necessary for deployment of computing is essential, but its effects are analytically separable from computer effects;
(c) infrastructural resources are available in necessary and sufficient quantities;
(d) the computing resource which is the analytical focus can be analyzed independently of interactions between it and other computing resources, or with the surrounding social arrangements; and
(e) organizations can be understood if their formal goals and procedures are known, and computing can be understood in terms of the formal features of the computer system.

Web models, in contrast, are described by Kling (Kling & Scacchi, 1982; Kling, 1978) as having the following characteristics:

(a) computing is conceptualized as a multifactor technology with unclear benefits and costs, and which is also a social artifact;

(b) infrastructure supporting computing is not only essential but is analytically inseparable from computer effects;

(c) infrastructural resources always are limited and are therefore subject to those organizational dynamics which determine resource allocation;

(d) computing outcomes are contingent on the interaction of the focal application with other applications and with the surrounding social arrangements; and

(e) organizations can be understood in terms of political interests, structural constraints, and subjective understandings of participants.

Kling is supportive of the use of web models, which he believes are able to capture more faithfully the reality of computing effects in organizations. Discrete entity models are handled more easily by the researcher, but fail to capture the full complexity of computing and its social
contexts. Web models are consistent with a combination of emergent causal agency with process logical structure, as described in the typology of Markus and Robey (1988).

Attewell and Rule (1984), in a literature review, held that the effects of computing in organizations were more complex than many analysts believed. Quality of work was among the topics examined; this section of the review was organized around the contrast between the predicted computer effects of deskilling or upgrading. Deskilling results from decreased skill content of jobs, and from reduction of the number of jobs requiring higher level skills. Upgrading results when routine work is computerized and worker time is freed for higher level tasks, potentially leading to reduced numbers of low skill jobs and increased numbers of high skill ones. The literature reviewed by Attewell and Rule (1984) contradicted the deskilling prediction, and was more consistent with upgrading.

Danziger and Kraemer (1986) used multiple methods, including case studies and surveys, to investigate how more than 3000 workers in 40 large urban governments used and were affected by computers. For analytical purposes they divided users into four groups based on their organizational roles: managers, staff professionals, street-level bureaucrats, and desk-top bureaucrats. The researchers deliberately focused on end users, defined as people who use computers, or products of computers, in the performance of
their functional activities. End users are to be distinguished from those workers whose jobs focus on running computers. In addition, the researchers included in their research potentially explanatory variables such as user characteristics, the sociotechnical interface, the computer system, and the organizational environment. Of these explanatory variables, the sociotechnical interface is most in need of definition; this is a set of user characteristics relating to the user's

"dynamic interaction with the computer package . . . ." which "... consist[s] of his/her experience with the computer package, such as completion of courses, years of computer use, and involvement in applications design activities, and also his/her cognitive, affective and evaluative orientations toward the computer package, such as the user's attitudes toward computers and the user's perceptions of the quality of the interactions with the computing staff" (p. 19).

The general findings of this research concluded that:
(a) end users reported generally positive effects of computers on their jobs, and relatively few problems;
(b) the distribution of benefits and costs among the four roles resulted in the largest gains being received by staff professionals, and the least by managers;
(c) contextual factors did influence the impact of computers;
(d) computer impacts are moderated by the degree of user discretion, resulting in computer impact on high discretion users being influenced most by user characteristics, while impact on low discretion users was influenced most by the characteristics of the computer system; however
(e) impacts on all users were influenced by both user characteristics and computer system characteristics, but were not influenced by the organizational environment.

Two areas investigated by Danziger and Kraemer (1986) which relate to the present research were the effect of computers on job performance and on the distribution of power in the workplace. Findings relating to computer impacts on job performance included:
(a) efficiency benefits were the least extensive impact as compared with informational benefits and, in particular, improved customer service benefits;
(b) the only role whose members reported efficiency benefits higher than the members of the other role groups were the street-level bureaucrats;
(c) for those users with less discretion whose performance benefits were closely linked with the nature of the computer package, these benefits were inversely related with the degree of development of that package;
(d) for all roles, efficiency impacts of computing are inversely related with the sophistication or extensiveness of the computing package; and
(e) individual user characteristics, especially the quality of the sociotechnical interface, and in particular the responsiveness of computing staff to end users, were a strong predictor of perceived performance benefits of computing.

Findings relating to power distribution included:
(a) in general, computing had little impact on the workplace environment; however,
(b) user perceptions of a higher sense of accomplishment, changes in time pressures, and in some cases an increased ability to influence others, were found;
(c) that where changes in user control were found these tended to be job enhancing; and
(d) variations within the four roles were not accounted for by computing.

Kraemer and King (1986) reviewed the literature on computing in public organizations, focusing on six topics: (a) organization structure; (b) employment; (c) work life; (d) decision making; (e) organizational politics; and (f) managing computing. Organizational structure and computing often have been linked by the question of whether computing centralizes or decentralizes organizations. Evidence suggested that computing could facilitate either of these tendencies, but that it did not cause them. Determining the effect of computing on employment is difficult, and was essentially unknown. Computing effects on work life are
more consistent with upgrading than with deskilling.  
Decision making has been affected by computing in several ways:
(a) model building provides a basis for defining the scope of the analytical problem;
(b) model specification disciplines the analytical process and makes the assumptions of analysts explicit;
(c) bargaining over model components helps parties to a discussion agree on which factors are important and which are not; and
(d) working with models helps educate decision makers and analysts, and improves their decision making skills.

Organizational politics also has been influenced by computing in several ways:
(a) information provided by computers is an important resource in bargaining during decision processes;
(b) control over computing resources is a source of power; and
(c) involvement with computing enhances the image of those so involved, which is also a source of power.

A basic question about computing and politics is that of who benefits. Kraemer and King (1986) present three alternative answers: (a) technologists will gain power; (b) computers will support a pluralistic dynamic in organizations; and (c) computers will tend to strengthen the existing distribution of power. The evidence cited by
Kraemer and King (1986) tends to favor the third view, the strengthening of existing power structures which has been called reinforcement politics.

Kraemer and King (1986) also review the management of computers, which has been addressed by an extensive normative literature. Kraemer and King state that more research is required to learn if these recommendations are valid. Some research shows that effective public computer management is associated with commitment to advanced technology. How to obtain the support for such a commitment is a leadership challenge for public computer system managers.

Gasser (1986) conducted field research in ten varied organizations. Adopting a symbolic interactionist perspective, Gasser sought to understand the nature of computer use for individual users, the factors that shape this nature, and how workers integrate computing into their routine work. The findings of this research included: (a) people must deal constantly with low level problems emanating from computer systems; (b) the nature of work with computers is determined by the fluid arrangements that characterize the relationship between computing and work; and (c) the ability of workers to adjust to the imperfection of computing systems depends on the use of several strategies; which strategy is adopted in a given case is contingent on
the relationships between the user, specialists and other key players.

The strategies used by workers in adjusting to computer systems are fitting, augmenting, and working around. Fitting occurs when either computing or the structure of work is changed to "accommodate a computing misfit" (Gasser, 1986, p. 214). Augmenting adds new work to existing work to achieve the same object. Working around involves either using computing in a fashion not anticipated by the system designers, or avoiding computer use and performing the work with alternative methods.

Majchrzak and Klein (1987) use an open systems perspective to discuss computer impacts on organizations. In this perspective, three input factors (technology, environment, and strategy) affect the interactions of four process variables (task structure, personnel system, formal and informal organizational structures), which leads to three outputs (individual attitudes and behavior, group and intergroup behavior, and organizational outcomes). In this conceptualization task structure is affected by three input actors and three process factors. Majchrzak and Klein list seven aspects of task structure which are affected by computers: (a) work pace; (b) information need; (c) coordination; (d) discretion; (e) variety; (f) flexibility; and (g) physical involvement. In manufacturing and office settings computers have been found to increase work pace,
information need, coordination and flexibility, and to
decrease physical involvement. Variation in variety and
discretion results from management implementation decisions
rather than from computerization.

Millman and Hartwick (1987) surveyed 75 Montreal middle
managers about their perceptions of the impact of computers
on their work. Two findings emerged from this research.
First, the respondents reported that their work had become
more demanding, but also that it was more rewarding, with
increases in autonomy, importance, and interestingness.
Millman and Hartwick related these perceptions to the job
design theory of Hackman and Oldham (1980), considering them
to be positive for both workers and organizations. Second,
there was a positive association between respondent's
experience with computer systems and their reports that
computer associated change was for the better.

Perolle (1988) used observational case studies to
examine the impacts of artificial intelligence on work in
both professional and technical contexts. Two different
models of implementation effects provided a framework for
analysis. The first model, expert replacement, occurs when
artificial intelligence systems supplant human experts.
Perolle considers this an application of scientific
management values. The second model, expert enhancement,
uses artificial intelligence to perform routine mental
tasks, freeing human experts to do more satisfying non-
routine tasks. This two model framework has a close affinity with the deskilling versus upgrading conceptualization discussed by Attewell and Rule (1984). Perolle found that whether one or the other model occurred in an individual case was dependent on "the implementer's assumptions about the nature of mental labor and the purposes of AI. . . . The outcome depends on the social organization of the . . . workplace, not on the . . . technology itself" (p. 8).

Kraut, Dumais and Koch (Kraut, Dumais, & Koch, 1989; Dumais, Kraut & Koch, 1988) examined the effect of substituting a computerized records system for a microfiche based system in the customer service department of a utility company. The research followed a lagged time-series design, involved both questionnaire and interview methods of gathering data, and focused on productivity, quality of worklife, and attitudes toward computers. Research findings included:
(a) productivity increased for the more routine tasks, which became easier to perform, but declined for less routine tasks, which were made more difficult by computerization;
(b) the knowledge which supervisors had of the skills required by the microfiche based system became obsolete under the computer based system, requiring supervisors to work harder and rely on their general knowledge and leadership skills in order to maintain their competence;
(c) quality of work life changes were mixed, with satisfaction, interest, and enjoyment decreasing, largely as a result of increased worker isolation and immobility (which resulted from physical office redesign rather than from the computer system), and with improvements resulting from decreased pressure, depression and anxiety;
(d) increased use of computers was associated with increased dislike of computers, but also with increased feelings of competence in using them; and
(e) the measured impact of technology was as large as other important contextual variables such as office size or type of customers served (residential or business), and was much larger than variables such as age, gender, quality of management.

Kraut, Dumais and Koch (1989) also analyzed interactions between variables, and showed how several contextual variables affected the impact of the computer system:
(a) office type, meaning whether an office serviced primarily residential or business customers, affected levels of outcome variables, with larger effects found in residential offices. The researchers attribute this difference to a combination of less computer use in business offices and a more authoritarian supervisory style in residential offices;
(b) high quality management mitigated negative effects and enhanced positive effects of the computer;
(c) office size resulted in reduction of negative effects and larger positive effects; and
(d) individual user characteristics did not have any interactive effect.

The causal model which Kraut, Dumais and Koch (1989) described at the beginning of their research was modified substantially as a result of their findings. The initial model was a simple unidirectional one, where managerial goals and design decisions determined technology, which then determined the tasks to be performed, which in turn determined worker attitudes and productivity. Such a model could fit Markus and Robey’s (1988) organizational imperative theory of causal agency. The final revised model added effects for contextual variables such as implementation strategy, organizational environment, and work procedures, and was no longer unidirectional. Many interactions and feedback loops were added. The model had moved away from an imperative conceptualization towards an emergent one (Markus & Robey, 1988).

Kraemer and Danziger (1990) in a review of the literature, examined how the interaction of computers, people and tasks affect six different organizational impacts: (a) decision making; (b) control; (c) productivity; (d) social interaction; (e) job enhancement; and (f) work
environment. In each of these impact areas the results were mixed and effects were modest. Kraemer and Danziger make several suggestions intended to promote better comparative analysis in this area:

(a) research needs to be guided by a systematic framework using commonly accepted concepts;
(b) the areas of control and decision making in particular have not had sufficient attention paid them by researchers;
(c) the reliance on subjective self report measures should be balanced with objectively measured variables;
(d) the lack of taxonomies of types of users, computer systems, and tasks make comparisons difficult;
(e) researchers are not paying sufficient attention to adequately specifying computer technology;
(f) researchers should pay attention to a greater variety of tasks, rather than focusing on only a few of these. Three broad tasks which deserve attention are information exchange, information storage and retrieval, and information analysis; and
(g) more research should be done in settings with a variety of task and technology mixes.

George and King (1991) reviewed the literature relating to the impact of computing on organizational centralization. They begin by describing four mutually contradictory theories: (a) computers cause centralization; (b) computers cause decentralization; (c) computers and centralization are
unrelated; and (d) computerization reflects centralization, the theory of reinforcement politics. The first two of these theories can be understood as representing the technological imperative theory, and the fourth as representing the organizational imperative theory (Markus & Robey, 1988). In reviewing the literature which supports each of these four theories, George and King describe a notion they call the management imperative, the idea that "management intent and action" (p. 69) is the primary factor shaping the relationship between computers and centralization, and show that this notion is assumed throughout this literature. By bringing out this common element they are able to move past the four opposing theories to effect a new theoretical position. However, George and King do not discard imperatives of a technological and organizational nature only to replace them with a managerial one. Arguing instead that the outcomes of computerization are determined in each situation by large scale ecological factors operating at the social and organizational levels, they suggest that the best way to understand these outcomes is as result of the tendency of computers to reinforce existing organizational arrangements. In this fashion George and King return to the reinforcement politics position after first discarding imperative theories in favor of an emergent one (Markus & Robey, 1988).
Danziger, Kraemer, Dunkle, and King (1993) investigated whether centralization of computing, service orientation of computing staff, and level of operational problems affected users' perceptions of quality of computing service. Data was gathered by surveying nearly 1900 individuals who worked for 46 large municipal governments. Neither centralization nor level of operational problems significantly affected user's perceptions of quality. The service orientation of computing staff had a strong effect on user perceptions of quality, accounting for nearly 18% of the variance. This finding is consistent with the findings of Danziger and Kraemer (1986) regarding the importance of the sociotechnical interface.

Despite its problems, the literature of computing and organizations has produced some useful results. The contrasting outcomes of deskilling or upgrading, and of centralization or decentralization, seem to result from the choices of managers and system implementers. The concept of reinforcement politics has obtained acceptance. Substantial effects of computing are measurable. Most workers find that computers improve their work, and they are able to adjust to the defects of computer systems. Supportive staff specialists have a positive effect on user's perceptions of computing quality. Routine work is absorbed by the computer, and the effects of this on people who formerly performed this work, as well as on supervisors whose
authority derived in part from knowledge of it, are considerable.

The weaknesses of this body of literature may derive from the attempt to build a new discipline for a new technology. This attempt has led researchers to unnecessarily create new research approaches, and in so doing pass by established theories and constructs from organizational science. The recent work of Danziger et al. (1993) demonstrates this quite well. The measure of technology used in this research is user perceptions of problems with the computer system, and the measure of organizational structure is whether the computer system is centralized or decentralized. A benefit of these measures is that they stay close to previous research, but they completely ignore the decades of work that organizational scientists have devoted to the study of technology and organizational structure (e.g. Miller, Glick, Wang, & Huber, 1991).

Researchers in this field have recognized that some integration with organizational science will benefit and strengthen it. For example, Zmud and Boynton (1991) have suggested the use of constructs and instruments from organizational science in computer effects research. The following section of this review turns to the organizational science literature relating to job design and job characteristics.
Job Design

Attention to the relationship between technology and job design goes back as far as Adam Smith in the eighteenth century, and the early twentieth century in the scientific management concepts of Frederick Taylor (Shafritz & Whitbeck, 1978). More recent research by organizational scientists focusing on technology has tended to examine the effects of technologies at the organizational level of analysis, the so called macro level (Gerwin, 1981; Miller et al., 1991). Although there is evidence of macro level effects of technology on organizations, Goodman, Griffith and Fenner (1990) maintain that "there are not well-developed concepts that . . . help explain and predict the interrelationship between technology and the individual" (p. 47).

The present research proposes that the relationship between technology and the individual can be approached by focusing on job design. After all, jobs are the locus where individual workers use technologies for organizational ends. The outcomes of the job design process, sensitive as they are to the nature of the technology, provide the link through which technology affects organizational design (Thompson, 1967). However, technology is not the sole factor affecting jobs, nor should the relationship between them be understood as unidirectional in character.
Campion and Medsker (1992) provide some useful definitions. A **task** is a set of actions performed by a worker that transforms input into outputs, while a **job** is a set of tasks assigned to a worker. When the focus is on the set of tasks performed by a single worker, then the term **position** is used, but when the focus is on a set of similar positions then the term **job** again applies, while an **occupation** is a collection of similar jobs. Thus, while a job can be understood as the set of tasks performed by a single individual, when job design is discussed it is more typically considered in terms of the aggregate of similar positions.

Cummings (Cummings & Huse, 1989) approaches job design from the perspective of organizational development. From this perspective job design involves balancing the demands of technology with the personal needs of workers. Cummings uses two dimensions of technology, interdependence and uncertainty, to suggest the different conditions under which four different types of job design should be adopted:

(a) traditional jobs;
(b) traditional work groups;
(c) enriched jobs; and
(d) self-regulating work groups.

Where uncertainty and interdependence is low, traditional jobs are appropriate, while traditional work groups are appropriate if uncertainty is low but
interdependence is high. If uncertainty is high but interdependence is low then enriched jobs are indicated, while if both interdependence and uncertainty are high then self-regulating work groups are appropriate.

Cummings' conceptualization of traditional jobs, whether individual or group, is based on scientific management and industrial engineering conceptions. These conceptions lead to job designs which consist of simple, highly specified, routine, repetitive components, with little attention paid to the personal needs of workers. In turning to enriched jobs, Cummings adopts Hackman and Oldham's (1980) theory of job enrichment, job characteristics theory, as exemplifying this type of job design.

In Hackman and Oldham's (1980) theory, five core dimensions of work (skill variety, task identity, task significance, autonomy, and intrinsic feedback) lead to three critical psychological states of the individual (meaningfulness, responsibility for outcomes, and knowledge of results), which result in outcomes (high motivation, performance, satisfaction, and low absenteeism and turnover) which benefit both the worker and the organization.

Cummings relates self-regulating work groups to sociotechnical systems theory (Trist, Higgin, Murray, & Pollock, 1963), a variant of open systems theory which proposes that the work setting is a system which combines
social and technological aspects. Because social and technological aspects are combined it is incorrect to design the system so as to optimize only the technological or the social component; instead joint optimization is necessary. Cummings suggests that the self-regulating work group is the mechanism which allows sociotechnical systems theory to be applied in practice. These groups require three conditions: (a) task differentiation; (b) boundary control; and (c) task control.

Task differentiation involves specifying the group's work as consisting of a set of interrelated tasks which constitute a relatively independent whole. Boundary control relates to the degree to which group members control the inputs to and outputs from their work. Task control involves the ability of the group and its members to determine how their work will be performed. Self-regulating groups require supporting changes in the support systems which affect them, and new styles of supervision.

Rousseau (1977) sought to synthesize job characteristics theory and sociotechnical systems conceptualizations, pointing out that the normative suggestions of these theories for changes in jobs were highly similar. She surveyed production employees of 19 organizations, using the Job Diagnostic Survey of Hackman and Oldham (1980) to measure job characteristics, as well as
several measures of job satisfaction and motivation. The 19 organizations were selected to represent the three classes of technology identified by Thompson (1967); long linked, mediating, and intensive. The hypotheses predicted that job characteristics, satisfaction, and motivation would vary according to technology, that satisfaction and motivation would relate positively to job characteristics, and that different job characteristics would be important for motivation than would be important for satisfaction. The results confirmed all the hypotheses with the exception that the job characteristics responsible for motivation were not independent of those responsible for satisfaction. Rousseau interpreted the results of this research as confirming the essential identity of job characteristics and sociotechnical systems conceptualizations.

In a theoretical paper, Slocum and Sims (1980) integrated a three factor model of technology with Hackman and Oldham's job characteristics theory. Slocum and Sims suggest that technology can be classified on three dimensions:

(a) workflow uncertainty;

(b) task uncertainty; and

(c) job interdependence.

Workflow uncertainty relates to the predictability of system inputs, while task uncertainty refers to the degree of knowledge the worker has for accomplishing the task, and
job interdependence is found when individual workers cannot produce output without some contribution from other workers, or some use of shared resources. This technology typology is similar to that used by Cummings (1989) to analyze types of job design.

Slocum and Sims (1980) then proceed to link their technology model with a three factor typology of managerial control. Systematized managerial control involves detailed procedures, uses standards and constant monitoring to evaluate performance, and typically is found when uncertainty is low and interdependence is sequential. Developmental managerial control involves general goals for achievement within specified time periods, and norms and expectation for employee behavior, and it typically is found when uncertainties are high and interdependence is low. The third type of managerial control is discretionary control, which provides a repertoire of plans for handling different situations, guidelines for how to exercise discretion, and goals for quantity and quality of output. As an intermediate form of managerial control it typically is found in situation where uncertainty and interdependence are at moderate levels. In addition to managerial control, workers exercise self regulation. Slocum and Sims suggest that systematized managerial control allows the least worker self regulation, while developmental control allows the most.
Slocum and Sims (1980) next examine four job redesign methods which are consistent with the job enrichment theory of Hackman and Oldham (1980). These are:
(a) combining tasks;
(b) forming natural work units;
(c) establishing worker relationships with customers; and
(d) adding higher responsibility tasks.

Slocum and Sims map these job redesign methods to the three technology factors, and conclude that job redesign must result in increased uncertainty or interdependence. Therefore, they conclude that job redesign changes technology. From this conclusion Slocum and Sims proceed to outline three potential managerial responses to technology changes, so that the focus of the discussion becomes the effect of technology changes on job redesign. Faced with changes in uncertainty or interdependence, managers have three options:
(a) retain the unit level control system but redesign jobs at the individual level;
(b) leave individual jobs unchanged but modify the unit control system; and
(c) trade off modifications at both individual and unit levels so that the uncertainty is handled at the level desired by the manager (Slocum and Sims, 1980).

In the late 1970s and early 1980s the Hackman and Oldham (1980) job characteristics model was subjected to
criticism. The literature reviewed up to this point has relied heavily on Hackman and Oldham's theory, so any threat to that theory must affect the interpretation of the work of Cummings (1989), Rousseau (1977), and Slocum and Sims (1980). The criticism of the job characteristics model was based on methodological and theoretical considerations. Roberts and Glick (1981) criticized the model from a methodological perspective, while Salancik and Pfeffer (1977; 1978) voiced theoretical concerns; the most powerful of Salancik and Pfeffer's arguments was the possibility that job characteristics were socially constructed realities.

Salancik and Pfeffer (1978) followed their criticisms of job characteristics theory by proposing an alternative, social information processing theory (SIP). SIP suggests that attitudes toward jobs are the results of social influences rather than innate characteristics of jobs. From this perspective, workers learn from their interactions with other how to perceive their jobs. Such influences as overt statements from co-workers, interactions that steer the attention of individual workers towards some things and away from others, interpretations of cues in the worker's immediate environment, and information from others about which needs are important and which are not, all contribute to the social construction of a worker's perceptions of their job. SIP also suggests that individual past behavior is a determinant of present perceptions. Salancik and
Pfeffer suggested that job characteristics theory is deterministic, while SIP allows workers to participate in the construction of their own realities.

Although the criticisms of Salancik and Pfeffer (1977; 1978) and Roberts and Glick (1981) were successful in directing attention at weaknesses in job characteristics theory, recent research has demonstrated its validity as a basis for measurement (Gerhart, 1988), and its viability as an explanatory model (Johns, Xie, & Fang, 1992).

Griffin (1987) used a review of the literature as a vehicle for the development of an integrated model of job design. He contrasted job characteristics theory with SIP, finding strengths and weaknesses in each. In particular, the two theories seemed to have different conceptualizations of the scope of jobs, and cannot be seen as competing explanations of the same phenomena. Griffin proceeded to build an explanatory model of job design, incorporating elements from both job characteristics theory and SIP. The model has five components:

(a) antecedent factors, which include objective job properties, individual attributes, and the physical and social settings;

(b) job/role dynamics, which consists of two potentially overlapping components, perceived job dynamics and perceived role dynamics;
(c) mediating factors, including job/role instrumentalities, social comparison and evaluation processes, and societal and cultural dimensions;

(d) internal/stable states, which include cognitive impressions of the job/role, satisfactions, and behavioral propensities; and

(e) external/expressed states, which include emotive and affective expressions toward the job/role, as well as actual behavior.

The model is completed with a feedback loop from external/expressed states to antecedent factors. This model is not intended to replace the job characteristics and SIP theories, but to show how to take better advantage of the strengths, and compensate for the weaknesses of each.

Griffin suggests that further theorizing is needed in five areas:

(a) how the link between antecedent factors and perceived job dynamics works;

(b) the appropriate conceptualization of job dynamics;

(c) the role of social comparison processes;

(d) the role of societal and cultural dimensions; and

(e) how the internal and external states are linked.

Griffin also suggests five areas where the model has implications for research:
(a) development of measurements which capture a broader range of task dynamics, such as the multidisciplinary instrument developed by Campion and Thayer (1985);
(b) greater attention to the organizational context;
(c) care in specifying whether their interest is in objective or perceived phenomena;
(d) the trade offs between specificity and generalizability must be acknowledged; and
(e) the recognition that the explained variance of even a successful theory cannot help but be limited by the effects of the huge array of factors which affect individual perceptions, attitudes, and behaviors.

Davis and Wacker (1987) provide a normative review of job design. Jobs should be designed to meet three organizational needs:
(a) production system needs;
(b) miniature society needs, which relate to the organization’s social aspects; and
(c) individual needs, which only partially overlap the needs of the organization.

Decisions required in designing jobs involve four sets of decisions:
(a) what tasks will be performed;
(b) how tasks will be grouped and assigned to individuals;
(c) how workers will be coordinated; and
(d) how individuals will be rewarded.
Deciding what tasks will be performed involves decisions about both technical and organizational tasks. Technical tasks are determined largely by the workplace technology. Organizational tasks, or social system tasks, involve coordination, planning, hiring, job assignment, training, performance appraisal, problem solving, and discipline. Deciding how tasks will be grouped together and assigned involves creating bounded segments of tasks so that workers know the extent of their responsibilities. This decision also involves technical and social components. The important principle in making these decisions is to balance the social and technical components, bearing in mind that decisions made for one component can constrain choices available in the other component. Coordination is primarily a function of the technical infrastructure which moves materials and information through the production process, however, social coordinating mechanisms, such as meetings, reporting relationships, communication procedures, and team identities, also plays a coordinating role. Reward system design involves determining what rewards will be given to individuals and what criteria will be used to determine the distribution of rewards. Davis and Wacker review different types of job designs, such as traditional or undesigned jobs, machine model jobs, designed according to scientific management principles, enlarged and enriched jobs, and self-maintaining work teams. The recommendations which Davis and
Wacker make are representative of the sociotechnical systems approach to job design.

Five years after Davis and Wacker's (1987) recommendations were published, a similar set of recommendations was published by Campion and Medsker (1992). Campion and Medsker recognized the work of Davis and Wacker, and follow it to a large extent. The major significant difference between Davis and Wacker (1987) and Campion and Medsker (1992), is that Davis and Wacker based their recommendations on sociotechnical systems theory, while Campion and Medsker use multidisciplinary job design theory as the theoretical underpinning of their suggestions. Multidisciplinary job design theory is discussed in greater detail later in this chapter.

Of all the job design concepts discussed, sociotechnical system theory makes the most explicit case for the relationship between jobs and technology; yet this theory also holds that job design also reflects a social component. Job characteristics theory contains a component, skill variety, which can be interpreted as reflecting technology. Rousseau (1977) demonstrated convergence between sociotechnical systems theory and job characteristics theory. Cummings (Cummings & Huse, 1989), and Slocum and Sims (1980), integrated job characteristics theory into technology based frameworks. Thus, the notion that job design can be useful in understanding the
interaction between technology and the individual seems to have support.

As suggested by Griffin (1987), a more broadly based conceptualization of job designs than those reviewed above has developed into a useful comparative tool. This is multidisciplinary job characteristics theory, which is reviewed in the following section.

Multidisciplinary Job Design Theory

Multidisciplinary job design theory is a response to the fact that several different normative models of job design exist. Campion and his colleagues have tried to integrate job design models from four different disciplines: (a) mechanistic job design, based on classical industrial engineering; (b) motivational job design, based on organizational psychology; (c) biological job design, based on human biomechanics and work physiology; and (d) perceptual/motor job design, based on experimental psychology and ergonomics (Campion & Thayer, 1985, 1987). In this research the biological model is omitted from consideration.

Campion and Thayer (1985) describe the initial development of multidisciplinary job design theory. In research carried out at the Weyerhauser Company, taxonomies and measures of job designs and of job outcomes were developed and tested. Each taxonomy was based on the literature, and so had content validity. The job design
taxonomy consisted of the four categories listed above: (a) mechanistic; (b) motivational; (c) biological; and (d) perceptual/motor. The job outcome taxonomy also consisted of four categories; these were satisfaction, efficiency, comfort, and reliability. It was hypothesized that:

(a) motivational job design would correlate positively with satisfaction and negatively with efficiency;
(b) mechanistic job design would correlate positively with efficiency and reliability, and negatively with satisfaction and comfort;
(c) biological job design would correlate positively with comfort; and
(d) perceptual/motor job design would correlate positively with reliability.

Job design was measured using an observational instrument, the Multimethod Job Design Questionnaire (MJDQ), which was developed on the occasion of this research; job outcomes were measured using existing scales applied in interviews with workers and supervisors, and through examination of archival data. The research hypotheses were supported by the data; in addition the perceptual/motor job design correlated positively with the efficiency outcome. These results demonstrated convergent and discriminant validity for the job design subscales of the MJDQ, with the sole exception that the perceptual/motor job design was more highly correlated with efficiency than with reliability.
The intercorrelations between the four job design types were also of interest:

(a) motivational job design correlated negatively with mechanistic and perceptual/motor design, but positively with biological design;
(b) mechanistic design correlated positively with perceptual/motor design; and
(c) perceptual motor design correlated positively with biological design.

Campion and Thayer (1987) developed normative recommendations for managers to use in applying multidisciplinary job design theory in practice. They suggested that the MJDQ can be used to diagnose problems, to guide job redesign projects, or in planning new organizations. They listed the various advantages and disadvantages of the four job design models, making it clear how managers can trade off these factors in deciding which job design models best fit their organizational needs.

Campion (1988) replicated Campion and Thayer's (1985) earlier research in a different setting, the electronics industry. Because many jobs cannot be measured using an observational instrument, a self report version of the MJDQ was developed for this replication. The research questions in this study asked:
(a) whether or not a different sample of jobs produced different findings;
(b) if the self report version of the MJDQ produced results comparable to the observational version;
(c) if different controls for method bias made any difference;
(d) how data aggregated at the job level compared with individual level data; and
(e) whether individual differences in job preferences or tolerances influenced results.

The study found no difference from the results of the 1985 study due to a different sample, use of a self report version of the MJDQ, or from using different controls for method bias. Aggregation of data at the job level produced larger correlations than individual level data did. Individual differences in preferences or tolerances had little moderating effect on the relationship of job design to job outcomes. An assessment of the reliability of MJDQ subscales using internal consistency and intraclass correlation as indicators demonstrated acceptable reliability in all four job design subscales. The findings of Campion and Thayer (1985) relating to convergent and discriminant validity were replicated.

Campion, Kosiak, and Langford (1988) examined the convergent and discriminant validity of the self report version of the MJDQ using multitrait-multimethod comparisons (Campbell & Fiske, 1959). Convergent validity was tested by comparing responses from supervisors with responses from the
workers who they supervised, and found to exist at a moderate level. The correlations between supervisors and subordinates are shown in table one.

Table 1

<table>
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<tr>
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<th>Supervisor-Subordinate Correlations</th>
<th>Intrasubscale Correlations</th>
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<tr>
<td>1. Motivational</td>
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<td>2. Mechanistic</td>
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<tr>
<td>3. Biological</td>
<td>.52</td>
<td>1</td>
</tr>
<tr>
<td>4. Perceptual/Motor</td>
<td>.25</td>
<td>1</td>
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Note: From "Convergent and Discriminant Validity of the Multimethod Job Design Questionnaire" by M. A. Campion, P. L. Kosiak and B. A. Langford, 1988, Paper presented at the annual convention of the American Psychological Association, Atlanta, p. 16. p < .05 one-tailed

Convergent and discriminant validity was tested by comparing responses to the MJDQ with responses to the Job Diagnostic Survey (JDS) (Hackman & Oldham, 1980), an instrument which measures motivational job characteristics. Scores on the motivational subscale of the MJDQ converged with JDS scores, while scores on other MJDQ subscales did not. The pattern of intersubscale correlations which was found in previous research (Campion & Thayer, 1985; Campion, 1988) was replicated; the values of these correlations are given in the three columns on the right side of table one. The researchers concluded that they had demonstrated
substantial convergent and discriminant validity, and that
the cumulative effect of research to date was supportive of
the construct validity of the MJDQ.

Campion (1989) examined how the different disciplinary
models of job design related to the ability requirements of
different jobs. This research extended the use of
multidisciplinary job characteristics theory to a line of
research which had focused previously on the relationship
between motivational job design and job ability
requirements. Data on job design was taken from previous
research (Campion & Thayer, 1985; Campion, 1988), while
ability requirements data was taken from the Dictionary of
The results confirmed previous research which found a
positive correlation between motivational job
characteristics and mental abilities. In addition a
negative correlation was found between mechanistic and
perceptual/motor job designs and mental abilities, and a
positive correlation was found between biological job design
and physical abilities.

Campion and Stevens (1989) carried out three
experiments relating to multidisciplinary job
characteristics theory using university students as
subjects. The first experiment investigated how individuals
with no formal training in job design would design jobs.
The result indicated that most naive individuals grouped
tasks into jobs based on similarities between tasks in function, activities, or required skill, and did this because it seemed the best, most logical approach. The second experiment compared global measures of job characteristics with aggregated measures of the characteristics of the tasks which the jobs contained. The result of this experiment indicated that global measures of jobs more validly represented job characteristics than did aggregated measures of the task components of jobs. The third experiment tested whether or not training in job design principles is effective. The result of this experiment showed that training in different models of job design did affect how trainees combined sets of tasks into jobs.

Campion and Berger (1990) investigated the relationship between multidisciplinary job characteristics theory and job analysis carried out for the purpose of determining compensation. Job design data from previous research (Campion & Thayer, 1985; Campion, 1988) was compared with new data on compensation and job analysis. Only pay information was available for comparison with the data taken from Campion and Thayer (1985), but detailed job analysis information for both exempt and non-exempt positions was available for comparison with the data taken from Campion (1988). The relationship between job design and compensation was found to be strong. Motivationally
designed jobs correlated positively with compensation and job analysis measures reflecting skill requirements, while mechanistic and perceptual/motor job designs had negative correlations with these measures. Biological and perceptual/motor job designs correlated negatively with job analysis measures reflecting physical requirements.

In summary, multidisciplinary job characteristics theory attempts to integrate four models of job design with different disciplinary origins. These four models are each associated with different outcomes, job ability requirements, and analytically determined compensation. Mechanistic job design, based on classical industrial engineering, supports the outcome of efficiency, and is associated with reduced skill requirements and compensation levels. Motivational job design, developed by organizational psychologists, supports the outcome of job satisfaction, and is associated with increased skill requirements and compensation levels. Perceptual/motor job design, which is based on experimental psychology, human factors and ergonomics, and supports the outcome of reliable performance, is associated with reduced skill requirements and compensation levels. Biological job design, which is based on biomechanics and work physiology, supports the outcome of comfort, and is associated with reduced physical requirements and compensation levels. A measurement instrument, the MJDQ, has been developed in both
observational and self report forms. This instrument was developed to assure content validity, and repeated tests have demonstrated acceptable construct validity and reliability. In practice the mechanistic and perceptual/motor subscales of the MJDQ correlate positively, while the motivational subscale correlates negatively with both, but has a small positive correlation with the biological scale.

The importance of multidisciplinary job characteristics theory for this research is fourfold: (a) it provides a measurement instrument which has demonstrated content and construct validity, and has acceptable reliability; (b) it is useful in researching the effects of computers on jobs because it can identify a variety of job characteristics; (c) it indicates that naive job designers tend to design mechanistic jobs (Campion & Stevens, 1989); and (d) it has demonstrated convergence with significant aspects of conventional personnel practice, which provides a basis for relating the findings of this research to public personnel management issues. In the section which follows the literature reviewed in this chapter is summarized and integrated.

Summary

The literature reviewed suggests that when libraries computerize both social and technological factors will affect library worker's jobs. Reinforcement politics
suggests that computerization will strengthen the existing bureaucratic structure. Library managers will not make explicit efforts to change job designs; they will be constrained by apprehension of loss of control to civil service classification processes and the accompanying potential for adverse budgetary consequences. Instead, managers implicitly will delegate the task of adjusting jobs to supervising professional librarians. These librarians, with little background in the various job design options available to them, and with the scientific management values of the classification system as an example, will tend to focus solely on adjusting jobs to fit their perceptions of the computer system's requirements. Also, some variation between library jobs which serve the public and those which do not can be anticipated.

The tendency of librarians to focus on customer service is another factor that will deflect attention from job design issues. To the extent that internal factors are considered they will be those that the profession has legitimized as appropriate: training, communication, fostering worker acceptance of computers while avoiding resistance. At the same time, the disappearance of the routine tasks of the old manual system will result in a migration of high level tasks down the hierarchy. This may weaken bureaucratic and professional control, countering the effect of reinforcement politics. Some supervisors and
professionals may lose the competence base they had
developed with the manual system, possibly raising
apprehensions of deskilling and deprofessionalization.

The literature provides some tools with which to
approach the question of the relationship of computerization
and jobs in libraries. Typologies can help assess different
concepts of cause and effect. Job design instrumentation
provides a valid and reliable method of assessing which of a
variety of possibilities actually exist on the ground. Data
can be compared with the patterns the literature predicts.

Having shown through this literature review how
existing theory and research inform the present research,
the next task is to present the design and methods used in
gathering and analyzing the data. This will be done in the
next chapter, which describes the methodology of this
research.
Chapter Three

This chapter describes the research methodology and explains its rationale. After presenting the overall research design, which is multimethod in character, the two main research components, a case study and a mail survey, are each described in detail.

Multimethod Research Design

Understanding the effects of an integrated library system (ILS) on job design presents a problem in research design. Comparisons between libraries with and without ILS are difficult to find, as most libraries now have these systems. This same reason makes it difficult to perform before and after comparisons. In order to overcome this problem a multi-method approach which combines case study and survey research methods is used.

Different research methods have different strengths and weaknesses. Survey research can measure well defined variables in a population of subjects, but does not capture social context or process well. Case study research can capture contextual and processual aspects of specific settings in a flexible manner, but does not provide findings which generalize to populations. Combining survey and case study methods in a multi-method approach allows the strength
of each method to compensate for the weakness of the other (Brewer & Hunter, 1989). The multi-method approach allows the use of convergent reasoning in the interpretation of results. Where both methods are in agreement, confidence in the accuracy of interpretations will be strengthened.

In their discussion of computer-driven organizational change, Markus and Robey (1988) distinguish between variance theories and process theories. Variance theories, "predict . . . outcome[s] from levels of contemporaneous predictor variables", while process theories, "explain . . . how outcomes develop over time" (p. 589). Since both types of theory seek to explain the same phenomena neither one can provide a completely satisfying account. Provision of a satisfactory account requires an integrative approach which merges the two perspectives.

The design of this research seeks such an integration. Survey research provides support for the variance approach through a cross sectional analysis of important variables. The case study approach allows a rich understanding of context and process. Combining the two approaches in a single study provides the researcher with the opportunity to integrate the process and variance perspectives.

Integration of the two design components, case and survey, rests on the use of the same instrumentation for measuring job characteristics in both research settings. Comparison of data from the survey sample with that from the
case study provides an objective basis for linking case study findings with findings from the mail survey. With this link in place it is possible to construct and defend arguments which draw support from both survey and case study data.

Before the research could be carried out, it was necessary to determine whether it complied with applicable standards for research using human subjects. This involved submitting the research proposal for review to the appropriate body, as described in the following text.

**Research with Human Subjects Review**

In October, 1995, the proposal for this research was reviewed by the Old Dominion University College of Business and Public Administration Institutional Review Board. The intent of the review was to determine if the proposed research met the criteria governing the use of human subjects in research. The research project qualified for expedited review, and was found to be acceptable. In the course of this review a form for documenting the informed consent process with interview respondents was examined and approved.

In the next section of this chapter the case study component of the multimethod research design is described in detail. Particular attention is paid to the design of the case, the methods used to gather and analyze data, and the data itself.
Case Study Research Component

The methodology of the case study component is presented here in three sections. First the design of the case is discussed, then the methods of gathering and analyzing data are described, and finally the data itself is reviewed. In addition, the case study protocol, which is a guide to the researcher for use in carrying out the research, is appended to this dissertation (Appendix One).

Case Study Design

The situation in the Norfolk Public Library presented a fortunate opportunity to conduct research in a single site. Norfolk Public, one of the larger public library systems in Virginia, was unable to begin implementing their ILS until 1990, due to delays in securing funding (Marshall, 1995). Where implementation of ILS is a recent event, people's memories are fresh, and the threat of limited respondent pools because of staff turnover is reduced. The combination of size and recent implementation made Norfolk a unique setting for investigating ILS effects. This unique character justifies the use of a single case research design (Yin, 1994). Design specifications for case studies include a statement of the questions to be investigated, and of the relevant theoretical propositions, identification of the unit of analysis, and description of the analytical logic (Yin, 1994). The specifications for this research are
described in the following sections, beginning with the case study questions.

Case study questions.

The case study seeks to answer three questions:

(a) Has computerization with an ILS changed job characteristics at NPL?;
(b) If so, what has been the nature of this change?; and
(c) Was NPL’s implementation of ILS consistent with one of the three causal perspectives identified by Markus and Robey (1988)?

The third question, which relates to identifying a causal perspective, represents an important contribution by the case study to the multimethod research design, as this question is not addressed in the mail survey. In considering how a causal perspective is to be identified, it is necessary to state several propositions. These propositions are set forth in the following section. . . .

Case study propositions.

The following propositions establish a basis for investigating the third case study question, which relates to identification of a causal perspective.

Organizational change associated with computerization is not highly determined. Computerization is not a sufficient condition for predicting specific and invariant organizational outcomes. Instead, the values and choices of
the organizational actors who select and implement computer systems play a major role in determining outcomes.

However, even though computerization is not determinant, a belief by organizational actors that it is determinant will lead these actors to behave accordingly. Such beliefs will tend to result in outcomes that are indistinguishable from those that would result from one of the imperative perspectives identified by Markus and Robey (1988).

Therefore, answering the third case study question, which relates to identifying the causal perspective which best explains how NPL implemented ILS, requires investigation of who is responsible for determining job characteristics at NPL, what values they use in making job design related decisions, and whether they believe that computers determine organizational outcomes.

These propositions will guide the search for a causal perspective. In the next section the issue of unit of analysis is discussed.

Case study units of analysis.

Identification of the unit of analysis focuses the inquiry. Incorrect identification of the unit of analysis can lead to collection of data which does not address the research questions. For example, if the research questions focus on an organization, but data is gathered about
individuals, then it is difficult to analyze the data so that the questions are addressed in a precise fashion.

In this case study the unit of analysis is the job. Jobs exist in a multi-factored organizational context. To the extent these factors directly affect jobs they are of interest in this research. Because interview and questionnaire methods produce data which is based on individual experience, it is important to note that the fact jobs are experienced at the individual level justifies linking individual level data to the job level. If this were not true, then individual level data would not be useful for this research.

Because contextual factors affect jobs, data gathered at other levels is also relevant. Organizational level data, such as annual reports and newsletters, and environmental data, such as professional norms and civil service regulations, are among the factors which condition job design. It is the ability of the case study method to include such contextual factors which makes it a powerful research design choice.

The job as unit of analysis will be the focus of data gathering in this case study. In the next section the analytical logic of the case study will be discussed.

**Case study analytical logic.**

Analytical logic refers to criteria for determining answers to the research questions based on the data. The
The first two research questions do not require complex criteria. The first question asks if computerization has affected jobs; an answer of yes or no will suffice. If the data do not support a clear answer of yes, then the alternative answer of no should be reached. The second question, which asks what was the nature of the changes in jobs, can be answered descriptively, and does not require choosing between alternatives.

In contrast to the first two questions, question three requires a choice between three different causal perspectives. Criteria which support use of a pattern matching logic are necessary to provide a data based answer to this question.

Among the questions included in the interviews were some which sought to gather data relevant to the contrasts between the three causal perspectives. These included who was responsible for determining job design, what theories were used in designing jobs, the source of the job design theories, what kind of jobs were planned, what kind of job resulted, and what changes were observed in jobs. These questions were designed to gather data which will support use of a pattern matching analytical logic.

The three causal perspectives identified by Markus and Robey (1988) are:

(a) the technological imperative, which sees the computer system as the causal agent;
(b) the organizational imperative, which sees the motives and acts of systems designers as the agent; and
(c) the emergent perspective, in which a dynamic process of interaction between internal and external factors is the causal agent.

Each perspective can be understood as resulting in a characteristic pattern. The technological imperative is indicated if ILS implementors lacked any interest in job design issues. The organizational imperative is indicated if ILS implementors took a rational planning process approach to job design issues, and the implementation encountered few or no unanticipated consequences. The emergent perspective is indicated if there was a complex implementation process, involving a variety of approaches to job design issues by implementors, a mixture of anticipated and unanticipated consequences, and an overlay of reactive adjustments to unanticipated factors during ILS implementation. The answer to question three depends upon which of these patterns is best supported by the data. Use of pattern matching logic in this fashion strengthens the internal validity of the case study design (Yin, 1994).

These criteria determine how the data analysis is analytically linked with the findings of the case study. In the section which follows criteria for determining the quality of a case study design are reviewed.
Case study design quality.

Yin (1994) has discussed criteria for assessing the quality of a case study research design. These criteria support construct, internal, and external validity, and reliability. Construct validity is supported through use of multiple sources of evidence, establishing a chain of evidence, and by having draft case reports reviewed by informants from the research site. To support construct validity in this research, a draft of the case study contribution to chapter four of this dissertation was reviewed by an informant from the research site. Internal validity can be supported by using analytical techniques such as pattern matching, explanation building, and time series analyses. The use of a logic of case replication in multiple case designs supports external validity. Reliability is supported through the use of a case study protocol (see Appendix One) and development of a case study database. These design quality criteria will be addressed in the sections on case study methods and data.

This concludes the description of the case study research design. In the next section the case study research methods are described.

Case Study Methods

Three different methods of data gathering were used in the case study component of the research. Questionnaires containing the content of the motivational, mechanistic, and
perceptual/motor subscales of the Multimethod Job Design Questionnaire (MJDQ) (Campion, 1988) were administered. An interview process, intended to capture information from the memories of participants in the ILS implementation, was carried out. Information contained in written form in archival materials was also sought out. Use of these different methods to provide multiple sources of evidence supports construct validity (Yin, 1994). In the following section case study questionnaire data collection and analysis is described.

**Questionnaires.**

A list of workers who have been employed since before ILS implementation in 1990 was obtained from the Norfolk Public Library administration; 54 individuals met this criterion for selection. The questionnaire instructions and content are included in the case study protocol (Appendix One). The 38 questionnaire items make up the motivational, mechanistic, and perceptual/motor subscales of the MJDQ. Two forms of questionnaire were prepared with identical items, but with different instructions. The instructions on one form of questionnaire asked respondents to answer in terms of their jobs in 1990, before computerization, while the other asked about their present jobs. This is a form of the retrospective pretest quasi-experimental design (Campbell & Stanley, 1963). These questionnaires were
administered to NPL staff at system wide staff meetings held in June, 1995, at the central library.

The questionnaire data contribute to two different analyses. The first of these two analyses focuses within the case study, asking whether former jobs differ from present jobs, while the other analysis seeks to establish a connection between case and survey components of the multimethod design.

In the first analysis using case study questionnaire data, the respondents' jobs in 1990 were compared with present job characteristics. The t-test for independent samples was used to test for differences between the two sets of scores.

In the second analysis, data from the questionnaire which asked about present job characteristics were compared with MJDQ subscale data from the mail survey. The purpose of this analysis was not to establish a difference but a similarity. Because of the different sizes of the two groups being compared it was not possible to directly compute a correlation between them. Instead, a combination of t-tests for independent samples and effect size correlations (Cohen, 1988) were used to support an argument that the two groups are similar.

Within the case study external validity cannot be supported using multiple cases because the design is of a single case nature. However, the analysis just described,
which uses questionnaire data to establish a link between the case study and mail survey research components does address the issue of external validity. External validity is supported by establishing the similarity or difference of jobs at NPL with jobs in Virginia public libraries in general. In the next section the use of interviews to gather case study data is discussed.

Interviews.

The following discussion addresses the interview portion of the case study component of the research.

Data from interviews serves several research objectives. By focusing closely on the topic of job characteristics it makes conceptual linkages with the survey component of the research possible. Interview data provides a context for interpretation of potentially ambiguous archival and questionnaire data. This data also adds a temporal dimension to the understanding by examining processes which have led to the present situation (Miles & Huberman, 1994). As described in the section on case study analytic logic, it provides a basis for use of pattern matching to identify a causal perspective. When entered into matrix displays it provides a basis for analysis and interpretation (Miles & Huberman, 1994).

Interview respondents were sampled using snowball sampling (Miles & Huberman, 1994). This technique consists of using early interviews to discover potential respondents
for later ones. During an initial interview, the Library's Assistant Director was asked to identify key individuals who had experienced the implementation of the ILS. The four individuals so identified then were interviewed, and in the course of these interviews each was asked to identify three additional key individuals. This procedure was to have been repeated until all potential interviewees were identified. However, the snowball sampling technique did not proceed as planned, requiring a change in the method of achieving closure for the process.

The intent of using the snowball sampling technique was to discover that core of organizational members who were most deeply involved in the implementation of the ILS. In theory, the method should lead to closure when suggestions by interview respondents for potential future respondents bring forward no new names. In the present research closure of the sampling process did not follow this pattern. Instead, it seemed that respondents were aware of which potential future respondents had not already been interviewed, and tended to name these people. There was ample opportunity for the respondents to know which of their colleagues had already been interviewed. The result was a lack of clustering around a core of organization members. Instead, many individuals were named only once or twice. Closure came about when a comment by a respondent made the researcher aware of her intention to name previously
uninterviewed individuals. A confirmatory analysis of the data regarding suggested interviewees was carried out. This analysis, combined with the researcher's judgment that additional interviews were disclosing little new information, provided a justification for bringing the interview process to a close.

Interviews were structured in the following manner. After first obtaining informed consent, including consent for use of a tape recorder, individual interviews were carried out using the funnel technique (Bouchard, 1976). This involved beginning the interview with non-directive questions and proceeding on to more structured questions. The technique allowed the interviewer to use responses from the later stages of the interview to loop back and obtain clarification of unclear earlier responses. During interviews respondents were asked to identify archival materials relevant to the research.

Data from the interviews was captured through tape recording. Where tape recording was not permitted, interviewer note taking was used. Even when tape recording was allowed, the interviewer still took notes. By taking notes even when tape recording was permitted, the researcher made sure that some data was gathered in case the tape recording should fail.

Yin (1994) points out the importance of creating a case study data base, which supports reliability, and maintaining
the chain of evidence, which supports construct validity. These principles were kept in mind in planning and implementing the qualitative analytic methods which are described next. A file folder was created for each interview respondent, and interview notes and transcripts were placed there. Tapes of interviews were labeled with the names of the respondents and the dates of the interviews, and were protected against unintended over-recording by removing the write protect tabs. As the data was analyzed, a point was reached where the identities of the respondents were obscured to maintain confidentiality. To maintain the chain of evidence each interview was numbered, and coded excerpts from interviews were then identified by number rather than by name. To assist in interpretation, general organizational role labels were created describing each respondent, and these labels remained linked to the data after the names of the respondents were obscured. These role labels were deliberately made vague enough that confidentiality could not be easily breached.

Data from tape recordings and interview notes were transcribed. These transcriptions were then coded using an a priori list of codes developed by the researcher. After a period of at least one week had elapsed since the first coding, clean interview transcripts were coded a second time, and the results of the second coding compared with
those of the first one. This check coding process (Miles & Huberman, 1994) provides some assurance of the validity of the coding process.

Pieces of coded text from the transcribed interviews, labelled with identifiers relating to the status of the respondent, were grouped together by code. This allowed the creation of a respondent by code matrix. By bringing coded information together in this fashion it was possible to highlight points of agreement and disagreement among the interviewees. Summaries by code of the coded interview content were prepared. This data reduction process allowed the identification of themes which can be considered the results of the analysis. In the following section the archival analysis portion of the case study is described.

Archival analysis.

Archival data serve the research objective of providing supplemental data which strengthens the analysis of data from interviews and questionnaires. As Bouchard (1976) suggests, archival documents "can never be taken at face value" (pp. 399-400). They can, however, provide information which supports or contradicts interpretations which derive from other sources.

During field work the researcher sought out potentially relevant documents, those relating to the implementation of ILS and its interaction with library jobs. During each interview the researcher asked to obtain copies of such
relevant documents. Interview respondents generally had difficulty making useful replies to this question, requiring the researcher to seek out these materials without a great deal of help.

Materials examined included:
(a) the operating and capital budgets for the City of Norfolk from fiscal 1988 through fiscal 1996;
(b) annual reports of NPL for fiscal 1991 through fiscal 1993;
(c) informational flyers used to keep NPL staff informed of ILS implementation activities, dated from June 1988 through September 1993 (Here's What's Happening! [HWH]);
(d) informational flyers issued periodically by NPL implementation task forces, such as the Bar Coding and the Registration Task Forces; and
(e) other miscellaneous NPL documents.

Most of these documents were supplied by the NPL Administration. Some were found in the NPL's vertical file, a file of materials on a variety of topics maintained in the library's reference department.

The informational flyers and annual reports made a substantial contribution to the preparation of a timeline for the ILS implementation project. The interviews did not focus on chronology, and so the bulk of this information came from the archival evidence. Where interview data
conflicted with archival data, the archival data was preferred.

The budget information included annual budget allocations to the NPL from the city of Norfolk, and also gave the number of staff positions. The budget figures were subdivided into four categories: (a) personnel; (b) materials; (c) general operation; and (d) equipment. This information made it possible to examine the trends of finance and staffing at NPL during the ILS implementation period, and also provided data for a correlational analysis.

In the next section the factors used to focus research attention on specific data is described.

Case Study Data

In interview and archival research a large mass of information is gathered, but only a potion of this information is relevant to the research topic. In order to select data from the interview and archival content a focusing method is required. The use of a list of codes, as described, provides a method for bracketing the relevant content. The factors, or organizing concepts, which lay behind the code list used in this research are described here. The original code list is included in the case study protocol (Appendix One).

The following factors are used as focusing concepts in the case study component of the research:
(a) responsibility for determining changes in the design of jobs;
(b) nature and source of the theoretical basis for changes in job design;
(c) nature of the planned changes in job design;
(d) nature of the actual, observed changes;
(e) professional status; and
(f) functional status.

In the course of coding the interview data, two additional factors emerged and were added to the list of codes. These factors are downsizing, which was mentioned by all the interviewees, and the contrast between central and branch libraries, which was added to the code list as "centralization". This concludes the presentation of the case study component of the multimethod research design. In the next section the mail survey component of the research is described.

Mail Survey Research Component

The survey component of this research provides objective evidence of the effects of computerization on library job characteristics. It also provides evidence for the moderating influence of professional and functional status on these effects. Because it uses the same MJDQ subscales as the case study questionnaire, the data from the survey can be integrated with the data from the case study.
The description of the mail survey portion of the research includes design, instrumentation, analytical methods, definitions, and hypotheses. In the next section the design of the mail survey is described.

Mail Survey Design

Mail questionnaires were administered to 277 individual members of the Virginia Library Association (VLA) who had indicated a special interest in public libraries. This indication of an interest in public libraries was expected to result in targeting a population of individuals who work in public libraries. This expectation was confirmed when only four percent of the respondents indicated that they did not work in a public library. Other VLA members, who were expected to work in other types of libraries (academic, school, business), were not included. The 277 respondents were selected by systematic random sampling from a mailing list of 565 individuals supplied by the VLA. Before sampling began, the mailing list was pruned to remove 11 entries with addresses remote from Virginia. The sampling procedure consisted of selecting a beginning point by chance, then starting from that point in the list and proceeding to select every second entry until the list was exhausted. The degree to which the survey responses were consistent with the expectations held regarding the characteristics of the population is described next.
Population.

The population of VLA members was anticipated to consist primarily of professional librarians. This weighting towards professionals was found to not be as extreme as had been assumed; 24 percent of the usable responses were from individuals whose jobs did not require a professional degree. The population was also expected to consist preponderantly of women, and the survey responses were consistent with this; 87 percent of the usable responses were from women. In the following section the questionnaire mailing procedure is described.

Mailing procedure.

The procedure for administering the questionnaires followed a modified form of Dillman's (1978, 1983) Total Design Method. This involved a carefully prescribed regime of questionnaire design, mailings and followups which has resulted in an average response rate of 77 percent in twenty eight surveys reported by Dillman (1983). In this research an overall response of 249 was obtained, a 90 percent response rate. The number of usable responses was 221, a usable response rate of 80 percent.

Four waves of survey mailings were carried out. The first, third, and fourth waves consisted of cover letters and questionnaires, while the second wave consisted of a postcard follow up to the first wave. The questionnaires were designed as booklets, and had return postage affixed to
them. Respondents were requested to tape the completed booklet closed and to then place it directly in the mail. The cover letters in each wave of mailings were different, and were designed to elicit a positive response from the recipient. The first wave of 277 surveys was mailed on October 17, 1995. 253 follow up postcards in the second wave were mailed on October 24, 1995. The third wave of 89 surveys was mailed on November 7, 1995, and the final wave of 35 surveys was mailed on December 5, 1995.

Respondents were requested to return the survey instrument even if they did not meet the survey criteria. 28 of the 249 responses were returned under these circumstances. These responses constitute the difference between the total responses and the usable responses. These 28 respondents indicated a variety of reasons for not meeting the research criteria:
(a) ten didn't work in a public library;
(b) eight were retired;
(c) nine refused to participate; and
(d) one had moved.

Another 28 individuals did not respond at all. These can be interpreted as refusals. Adding these refusals to those of the nine people who indicated refusal by returning their questionnaires produces a total of 37 refusals, a 13 percent refusal rate overall. In the next section the content of the survey instrument is described.
Instrumentation

The survey questionnaire booklet was pretested on a convenience sample of ten library workers at the Eastern Virginia Medical School, located in Norfolk. Mean time to complete the test was 8 minutes 34 seconds; the standard deviation was 1 minute and 54 seconds. This result allowed potential respondents to be told that the questionnaire could be completed in about ten minutes. The pretest also sought to identify ambiguous or confusing text; the potentially ambiguous phrase "integrated library system" was improved to "integrated library computer system". This change assures that respondents would not confuse ILS with other, non-computer, library systems.

Three subscales of the self report version of the MJDQ (Campion, 1988) were used in the research. Literature reviewed in chapter two describes several validation studies with this instrument. The original development of the MJDQ was based on an extensive literature review, which provided assurance of content validity. The subscales demonstrated convergent and discriminant validity in an application of the multitrait-multimethod approach to validity testing (Campion, Kosiak, & Langford, 1988). Convergent validity with the U. S. Dictionary of Occupational Titles has also been demonstrated (Campion, 1989; Campion & Berger, 1990). The three subscales used in this research correspond to the motivational, mechanistic, and perceptual/motor approaches.
to understanding job characteristics. The motivational subscale includes 18 items, the mechanistic subscale has 8 items, and the perceptual/motor subscale consists of twelve items. The literature describes these three subscales as having a characteristic pattern of correlation between them, with the mechanistic and perceptual/motor subscales being positively correlated, while the motivational subscale is negatively correlated with the other two subscales. In the next section the analytical method is described.

**Analytical Methods**

Mail survey data are analyzed using hierarchical multiple regression analyses, where the three MJDQ job design subscales are the dependent variables and the other questionnaire items are the independent variables. With twelve independent variables and an anticipated medium effect size ($R^2 = .13$), an $N$ of 110 should provide acceptable statistical power ($\alpha = .05, \beta = .20$), as recommended by Cohen (1988). Control variables are included in the first hierarchically structured set of variables to enter the regression analysis. The variables which are used for testing hypotheses are entered in the regression analysis as members of the second hierarchical set. By entering the control variables in the first hierarchical set, the analysis accounts for all the variance associated with these variables before the second set of variables for hypothesis testing are entered. This is a conservative method of model
construction which allows the unique contribution of the hypothesis testing variables to the total variance explained by the model to be assessed (Tabachnick & Fidell, 1983).

The regression models include data coded as dummy variables, and also interaction terms. Professional status and gender are both binary concepts, and so are appropriately represented by dummy coding. In each case the most numerous group was selected as the reference group. Thus, professionals were coded zero while other workers were coded one, and women were coded zero with men receiving a coding of one.

Two interaction terms were created and included in the analysis for hypothesis testing purposes. One of these is the interaction between the extent of computerization with ILS and the percentage of time spent working with the ILS. The other interaction term is the product of professional status and the percentage of time spent working with the public.

Descriptive statistics were tabulated, and correlations between the three MJDQ subscales computed. The pattern of intersubscale correlations is of interest. If this differs from the characteristic pattern found in previous MJDQ based research, this may have implications for the generalizability of multidisciplinary job design theory, and may indicate that the population under study in this research is different from the populations studied by
Campion. In the next section the definitions of the survey variables are stated.

Definitions

In this section the dependent and independent variables used in the mail survey are defined. Although the emphasis here is on the mail survey, these definitions also have applicability in the case study.

**Dependent variables.**

The dependent variables are three different types of job characteristics. Job design characteristics are operationalized using the mechanistic, motivational, and perceptual/motor subscales of the MJDQ (Campion, 1988; Campion & Thayer, 1985). These subscales measure the characteristics of jobs from three different disciplinary perspectives:

(a) a classical industrial engineering, scientific management perspective;

(b) a social and organizational psychology perspective; and

(c) an ergonomic, human factors perspective.

**Independent variables.**

Professional status means that an individual worker holds a graduate degree in library science from a program accredited by the American Library Association, and that their job requires such a degree. Functional status refers to whether a worker's primary job responsibility does or does not involve working with the public.
An integrated library system is a multi-user computer based system which supports library operations. Such a system shares centralized files between its different functions; these files include records representing both library customers and library materials. Functions supported by an ILS may include any or all of the following: (a) online public access catalog; (b) cataloging; (c) acquisitions; (d) serials management; (e) binding; (f) circulation; (g) accounting; and (h) collection development (Johnson, 1991).

An ILS may run on any type of computer system (mainframe, minicomputer, or microcomputer), and may be centralized or decentralized in design. Computerization with an ILS is operationalized with two variables. The first of these two variables measures the extent to which an ILS is present in the respondent's workplace. The respondents were asked to indicate which of the eight listed ILS functions are present in the library where they work. This variable controls for differences in degree of computerization with an ILS between the different libraries where the respondents are employed.
The second variable which operationalizes computerization with an ILS measures the extent to which the respondent uses the ILS in their work. The respondents were asked to indicate what percentage of their work time is spent using the ILS, using a scale from zero to 100.

Job level is operationalized as the number of individuals the respondent supervises. Because supervisory and managerial level jobs can be expected to score higher than production level jobs on the motivational subscale, Campion and Thayer (1985) included a control for job level in their research design. Their results indicated that job level was a significant moderating variable in the relationship between job characteristics and job outcomes, although its effects were small.

Library size is operationalized as the number of individuals who work in the library where the respondent is employed; employees at branch libraries are included in this number. Organizational size has been found to be an important variable in research on organizational effects of technology (Gerwin, 1981).

The prior research synthesized by Campion in assessing the content validity of the MJDQ indicated that individual characteristics, such as age, gender, and job tenure, could affect job characteristics (Campion & Thayer, 1985; Campion, 1988). Campion’s research did not find a significant effect of these variables on the relationship between job
characteristics and job outcomes. However, the proposed research uses job characteristics as a dependent variable, while Campion's findings of no significance occurred in research where job characteristics were the independent variables. Because of this difference, it is prudent to include these three individual characteristics variables in this research.

Age is the respondent's age in years. Gender is a binary dummy variable, either female or male. Years employed is the number of years the respondent has worked in their current library of employment. It is not the number of years worked in their current position within that library. In the next section the hypotheses which are tested with mail survey data are stated.

Hypotheses

The following null hypotheses are tested using data from the mail survey component of this research. There are four general hypotheses; each of these is stated below three times, in order to create a separate hypothesis for testing with each of the three MJDQ subscales. The hypotheses are stated in a non-directional way, because the literature of computing effects shows that the direction of these effects are unpredictable.

H$_{10}$: Library motivational job characteristics are not affected by computerization with an ILS.
H2o: Library mechanistic job characteristics are not affected by computerization with an ILS.

H3o: Library perceptual/motor job characteristics are not affected by computerization with an ILS.

H4o: The effect of ILS on library motivational job characteristics is not moderated by professional status.

H5o: The effect of ILS on library mechanistic job characteristics is not moderated by professional status.

H6o: The effect of ILS on library perceptual/motor job characteristics is not moderated by professional status.

H7o: The effect of ILS on library motivational job characteristics is not moderated by functional status.

H8o: The effect of ILS on library mechanistic job characteristics is not moderated by functional status.

H9o: The effect of ILS on library perceptual/motor job characteristics is not moderated by functional status.

H10o: The effect of ILS on library motivational job characteristics is not moderated by the interaction of professional status and functional status.

H11o: The effect of ILS on library mechanistic job characteristics is not moderated by the interaction of professional status and functional status.
H12p: The effect of ILS on library perceptual/motor job characteristics is not moderated by the interaction of professional status and functional status.

In the next section of this chapter the details of the research methodology are summarized.

Summary

The effects of ILS on library job design has been investigated by combining survey and case study approaches in a multimethod research design. The survey approach provides a broad overview of the effects of ILS on job design which then is integrated with the rich detail provided by the case study. Use of the same dependent variable scales in both survey and case study provides a strong link between the two research components. Survey data is analyzed using multiple regression analysis.

The case study methods include interviews of key individuals, archival analysis, and questionnaires. A form of retrospective pretest design was used in administering the questionnaires. Qualitative analytic procedures including interview coding, data matrix building, pattern matching, use of archival materials as corroborative evidence, and triangulation between data collected using different methods are employed.

Each method used has its limitations. None alone is sufficient to provide robust support for research conclusions. It is the combination of findings which
provides a strong foundation for research conclusions. The results of the data analyses are reported in detail in the following chapter.
Chapter Four

This analysis is presented in two sections. The first section analyzes the data from the case study component of the research design, and the second section examines the mail survey component.

Case Study Analysis

Introduction

The Norfolk Public Library (NPL) serves a population of 237,570 (U.S. Bureau of the Census, 1996), and circulates 824,000 items a year. The system has a central library, Kim Memorial Library, located in downtown Norfolk, which houses administrative and support units in addition to providing services to the public. The NPL system also includes 11 branch libraries distributed across the city, and provides bookmobile service. The central library has a local history collection, and also serves as a depository for U.S. government publications (American Library Directory, 1992).

NPL is a MURL, a major urban resource library, a status awarded by the Library of Virginia. MURL status indicates that the NPL collection has a sufficient quality to serve as a statewide resource, and by accepting this status NPL agrees to open its doors to all citizens of the Commonwealth.
of Virginia. In exchange, NPL has the opportunity to apply for federal funds which are administered by the Library of Virginia (Hahne, 1996).

Because it is located in Norfolk, NPL is subject to a constrained fiscal environment. Norfolk, which had the largest population of any Virginia city for many years, lost this status to its neighboring city, Virginia Beach, with the 1990 census. This decline in population has been accompanied by a reduction in the size of the city workforce.

Before 1987 NPL was unable to secure funding for library computerization from the City, but in the 1988 budget year this changed (Norfolk, Va. Approved capital improvement program, 1988). However, at the same time as NPL took on computerization, it was also subjected to reductions in staff. In the following account the budget and staffing at NPL from 1987 to the present is analyzed. Then the chronology of the computerization project is examined. Following this, actions taken by NPL to adjust to the changes resulting from reduced budgets and computerization are discussed. Finally, data relating to job characteristics at NPL are analyzed. In the section which follows an analysis of NPL budget and staffing is presented.
Budget and Staffing

In 1988 Norfolk began a three year period of capital budget support for computerization at NPL (Norfolk, Va. Approved capital improvement plan, 1988-1990). These capital expenditures are shown together with NPL operating budget figures in table two, which covers the period 1988 through 1996.

Table 2

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<td>4.45</td>
<td>4.11</td>
<td>4.33</td>
<td>4.25</td>
<td>3.85</td>
<td>3.72</td>
<td>3.58</td>
<td>3.69</td>
<td>3.54</td>
</tr>
</tbody>
</table>

Note. Opr = Operating budget. Cap = Capital budget. Tot = Sum of operating and capital budgets.

Source: From City of Norfolk, Va., Approved Operating Budget, 1988-96, and Approved Capital Improvement Program Budget, 1988-96.

Bland and Nunn (1992) have shown that city capital budget expenditures tend to result in increased operating budget expenditures. This tendency exists because new capital investments frequently require additional operating expenditure for their operation and maintenance. In the case of public libraries, Bland and Nunn found that a two year time lag existed between capital expenditures and increases in operating budgets. This pattern is evident in
the data from table one for the period 1988 through 1991. Capital expenditures occurred in 1988, and the operating budget increased in 1990. Similarly, a capital expenditure in 1989 is echoed by an operating budget increase in 1991. However, after this point in time the pattern changes in a way not predicted by Bland and Nunn’s findings. Even though a capital expenditure was made in 1990, the operating budget in 1992 shows a decrease. This would indicate that the increased operating costs resulting in 1992 from the capital expenditure of 1990 would have to be met by NPL out of a reduced operating budget.

One reason for making capital expenditures is to replace labor with equipment, with the objective of reducing operating costs (Bland & Nunn, 1992; King & Kraemer, 1985). "Automating libraries may replace librarians" (Bland & Nunn, 1992, p. 35). King and Kraemer (1985) found that roughly one third of the 40 large cities in their research had realized savings from computerization by reducing numbers of staff. These 40 cities were located in the United States; King and Kraemer (1985) found that the practice of replacing staff with computers was much more prevalent in 16 OECD cities in Europe and North America. Four fifths of the OECD cities had reduced staff through computerization.

Table two includes data for budgeted staff positions at NPL (Norfolk, Va. Approved operating budget, 1988-1996). During the period from 1988 through 1996 NPL lost 50
positions, a 45 percent reduction from the 1988 base figure. A strong relationship exists between staff and budget data at NPL over this period. Total budget, which includes both capital and operating budget amounts, is highly correlated with staff ($r = .966, p < .0005$ one tail). Figures one and two graph the changes in total budget and staff over the period. Visual examination of these figures indicates that the trend lines for both staff and budget which existed through 1991 were broken in 1992; after 1992 different trends emerged.

Data from the 1990 capital budget indicates that the annual maintenance cost for the ILS was $365,000 (Norfolk, Va. Approved capital improvement program, 1990). In 1992 the average personnel cost of a NPL staff member was $38,700 (Norfolk, Va. Approved operating budget, 1992). By cutting 19 staff that year NPL saved roughly $735,000, which is about twice the amount required for ILS maintenance. If paying for ILS maintenance were the sole consideration, then a cut of only nine positions would have sufficed ($38,700 \times 9 = $348,300). Evidently the cost of ILS maintenance was not the only factor determining staff cuts in 1992.

**Budget and Staffing Summary**

The evidence presented here provides support for the assertion that the steep reduction in staff at NPL from 1988 to 1996 was partially a consequence of the interaction between reduced operating budgets and new costs of the
Figure 1. NPL Budget 1988-1996

Figure 2. NPL Staff 1988-1996
computer system. Budgets are certainly a product of administrative choice, and so are staff reductions. The sequence of events described here is consistent with an administrative strategy of automation, of replacing people with machines. Many NPL staff interviewed for this research noted a belief on the part of other individuals that computerization meant that less staff were needed.

The decreases in budgets and staff presented NPL with a difficult situation. Time would be needed before the ILS could produce any efficiency benefits, and the resource cuts had anticipated the arrival of those benefits. As it turned out the time required for implementation was much longer than was anticipated. Numerous technical problems intervened, and the way that NPL chose to staff the implementation project with existing personnel introduced the additional delaying factor of a steep learning curve.

Before proceeding to describe the history of the implementation project, the characteristics of those NPL staff who responded to interviews is examined next. This is made particularly necessary by the fact that the identities of interview respondents are obscured, and citations to interviews will therefore be of a general nature.

Interview Respondents

Much of the material which follows is based on data from interviews. These interviews were held under a promise of confidentiality, and so the identities of the respondents
are obscured. Where interview sources are used or quoted, attribution is to the role of the individual, with information provided on job level and location. For example, a citation to an interview may attribute it to a central library department head, or to a branch library non-professional.

The extent of coverage of NPL staff by the interview process is shown in Table 3.

Table 3
Status of Norfolk Public Library Interviewees

<table>
<thead>
<tr>
<th>Department</th>
<th>Admin</th>
<th>Dept. Head</th>
<th>Prof.</th>
<th>Non-prof</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automation</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Business Office</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Processing</td>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Reference</td>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Branch Library</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Note. N = 21.

The interview process tended to select high level staff rather than lower level ones, but the inclusion of eight non-professional staff among the 21 interview respondents compensated for this potential selection bias. The respondents included three administrators, eight department heads, two other professionals, and eight non-professionals. Staff from six of seven central library departments were
included. These departments were administration, automation, business office, children's, processing, and information (reference); circulation was not included. Eight of eleven branch libraries were covered. In the following section the history of the implementation project is described.

**Implementation**

Computerization with an integrated library system (ILS) came to NPL later than it did to the public libraries in the neighboring cities. In fact, some staff at NPL believed that of all the public libraries in the United States which serve a community of Norfolk's size, NPL was the last one to bring up an ILS (Interview with a central library non-professional). The delay resulted from the unavailability of city funding to support a computerization project. City funding finally became available in fiscal 1988. The story begins after funding was awarded and the selection of an ILS vendor was about to be made.

**System Selection**

NPL used consultants in the earlier stages of the project to help with planning, presentations to governing bodies, and vendor selection (Interviews with a central library administrator and a department head; HWH, November 18, 1988). By the time the vendor selection stage was reached NPL administration began to involve library staff in the project (Interview with a central library department...
head). In the summer of 1988, representatives of the competing system vendors presented their products to a staff group, the Automation Committee (HWH, September 30, 1988). At the time this committee was established three supporting task forces composed of volunteers were also created. Each task force consisted of 13 or 14 people; they were to focus on the computerized public catalog, circulation, and technical services (HWH, June 28, 1988). In November 1988 the final vendor selection was made (HWH, November 18, 1988); the decision was reached through consensus agreement of the library administration and the Automation Committee. In order to implement the ILS the plan now called for the appointment of a manager who would coordinate the entire project (Interview with a central library department head).

**Automation Project Manager**

The computerization project plan specified that a new staff position of automation project manager would be created. This position was to be filled from outside the NPL staff with an individual having substantial experience in computerizing libraries. The position was to be responsible for managing the operation of the new computer hardware and software, and for implementing the ILS throughout NPL. Because of decreasing budget support from the City, this position was filled from within NPL by a competent librarian who had little knowledge of computers. The automation project manager was appointed in August,
1989, near the beginning of the 1990 budget year. The first task confronting her was the negotiation of the contract with the ILS vendor (Interview with a central library department head).

Contract Negotiation Delay

There had been some delay in appointing the automation project manager, and the project continued to experience considerable delays. The NPL’s plan allowed three weeks for negotiation of the contract between NPL and the system vendor (Interview with a central library department head). In fact the negotiation, which involved members of the city’s computer and legal staffs, took 18 months; the contract was finally signed in April, 1990 (HWH, April 20, 1990). Work on the ILS was delayed during the negotiation, but this gave the new automation project manager time to learn more about her new responsibilities. Thus, the signing of the contract was the signal for a flurry of activity at NPL.

Contract Signing and the Beginning of Work

Once the contract was signed the implementation project could proceed. The computer hardware and software was procured, a site was prepared for the VAX minicomputer at the central library building, and the VAX was installed and became operational (HWH, June 11, 1990). An operational regime for managing the central computer facility was designed and implemented. At the same time work proceeded...
to prepare the data which would be loaded into the system. As installed in June 1990, the VAX contained only its operating system software and the ILS software provided by the system vendor. It needed to have NPL's unique data loaded before the ILS could become operational, and preparing this unique data was a mammoth task (Interview with a central library department head). Furthermore, problems arose in the preparation of this data, which contributed to the general problem of delay.

Database Preparation

The unique data for NPL consisted of three components. One of these was the database of all registered customers, another was the database of all bibliographic entities in the library's collections, and the last, which would be merged with the database of all bibliographic entities, were records of all the physical items in these collections. As the item records were merged with the bibliographic database, each item record had to be linked to the specific bibliographic record which described it.

While considerable effort was put into creating a high quality customer database, less care was given to the bibliographic database. Although some bibliographic records were already in computer usable MARC format, a large number existed only as paper records. In November, 1988, a contractor was selected to perform the work of creating a file of matching computer records (HWH, September 30, 1988).
This work was completed by April, 1990 (Memorandum to NPL staff from the Automation Project Manager, April 9, 1990). Because many items recorded in the paper bibliographic file had been lost, the result was a computerized database which included numerous items which were no longer in the NPL collections. This would cause many problems, and later would require the establishment of a special project for the purpose of cleaning up the bibliographic database (Interviews with three central library department heads, and also with one branch library non-professional).

The three database components, of customers, bibliographic records, and item records, required further supporting work. The database of bibliographic records had to be integrated with an authority file of access points; these access points are the keys which are used when the database is searched. In addition, physical barcode labels had to be prepared. These labels were to be attached to physical items, and their numbers linked to the corresponding item records in the database (Interview with a central library department head).

Preparation of the bibliographic and item components of the database were performed by the ILS vendor. The specifications for this work were delivered to the vendor in June, 1990. In December, 1990, the vendor was still working on the database translation table (HWH, December 3, 1990), which was a prerequisite for the actual loading of the
bibliographic data. After further delay, the bibliographic database was loaded by the vendor in mid February, 1991 (HWH, February 19, 1991). This allowed training for Processing Department staff to proceed. In March, 1991, when the communication link between the ILS and the OCLC service (the source of MARC bibliographic records) became operational, the Processing Department began using the ILS as their main production tool (HWH, March 11, 1991). Thus, the first module of the ILS, cataloging, was brought into service.

When the system vendor had concluded their work to load the NPL database in February, 1991, NPL staff realized that the item record file was deficient (HWH, February 4, 1991; February 19, 1991). This resulted in negotiation with the system vendor for further work which was required to fix the problems. The file was analyzed by NPL staff in February, and in March the vendor agreed to recreate the file (HWH, March 11, 1991). This work was carried out in May, 1991, with mixed results.

Meanwhile, at the end of January, 1991, a tape of the NPL’s data was sent to the contractor who was to create the barcode labels (HWH, December 28, 1990). Two kind of barcode labels were used by NPL. Dumb barcodes were generic in character. They could be applied to any item and then linked with a computer item record by a human operator. Smart barcodes, in contrast, were prepared by the contractor
with links to item records already established. This meant that the process of applying smart barcodes required a worker to match the data on the barcode label with a specific physical item (HWH, October 1-5?, 1990). The NPL Processing Department began applying dumb barcode labels to new library materials at this time, in January 1991 (HWH, January 28, 1991). The smart barcode labels were delivered by the contractor in June, 1991 (HWH, July 1, 1991).

Completing the loading of the bibliographic database in February, 1991, allowed the preparation of a tape copy of the database which was sent to the contractor who was to create the authority file (HWH, March 11, 1991). In June, 1991, the authority file records were delivered by the vendor, and were loaded into NPL’s database (HWH, July 1, 1991).

Because of the delay in getting the ILS running, a method was sought for expediting creation of the new customer database. Staff from the City’s Department of Information Services programmed a microcomputer application which allowed creation of customer registration records. These records were later to be moved from the microcomputers into the ILS customer registration database. The micro based program began being used to gather customer information in May, 1991 (HWH, May 20, 1991).

Thus, by the end of fiscal 1991 much progress had been made. The minicomputer and the ILS software was installed,
and the cataloging module of the ILS was in use. The bibliographic and item components of the database were loaded, as were the authority records. Smart barcodes were in hand, and customers were being re-registered on microcomputers. While the database and its problems were being worked through, concurrent efforts were carried out to install the hardware infrastructure which would allow the ILS to be used throughout the geographically dispersed NPL system.

Site Preparation

Site preparation involved three aspects. The central telecommunication support equipment had to be installed and made serviceable. Electrical and communication wires had to be installed in the NPL’s physical plant. When the ILS was ready to be delivered in the branch libraries, phone connections had to be arranged with the phone company. Of these three aspects the first was the most difficult. Delivery of the communication hardware was delayed. This was noted as a problem in August, 1990 (HWH, August 20, 1990), and delivery did not take place until October, 1990 (HWH, October 22, 1990). At the end of October, 1990, the ILS vendor made a site visit to install the system telecommunication software and ran into problems (HWH, November 13, 1990). These problems were not resolved until February, 1991 (HWH, February 4, 1991). The communication hardware continued to give trouble; in July, 1992, bugs in
this area of the system were limiting the number of terminals able to connect with the VAX (HWH, July 31, 1992). Eventually, NPL upgraded out of this problem in June of 1993, by moving to the LAT protocol (HWH, June 25, 1993), which is produced by the same vendor who makes VAX minicomputers.

In contrast the installation of electrical and communication wires went very smoothly. In June, 1990, a contract was signed with an electrical contractor to perform this work (HWH, June 20, 1990). The work began almost immediately, and was substantially completed in the central library and branches by the end of September, 1990 (HWH, October 5, 1990).

The phone lines which were necessary for communication between the branches and the central computer were not needed until March, 1992. At that point they began to be brought into service (HWH, February 28, 1992; April 2, 1992), and were all operational by May, 1992. One benefit of this was that the work of the barcoding workers in the branches was facilitated by being able to work with the central computer from a branch terminal.

Site and database preparation were large tasks, but many other tasks needed attention. The automation project manager and the library administration realized that these tasks were beyond the scope of a single person. They responded by forming a number of task forces from the
library staff (Interview with a central library department head). These task forces were to focus on different pieces of the implementation project and develop detailed proposals for carrying them out. In some cases, task forces actually implemented the plans they had prepared.

Use of Task Forces

NPL had used staff task forces during the process of system selection. Once selection occurred these task forces dissolved. Now the demands of the implementation process resulted in the creation of new task forces. The most important task forces at the early stages of implementation were barcoding, registration, and patron relations.

The barcoding task force was responsible for planning the linking of barcodes with the computer records for all the physical items in the library's collections. The name "barcoding" came from the fact that each computer record was physically linked with its corresponding physical item by a barcode label. These labels had to be attached to the physical pieces and also entered into the computer. The leader of this task force went on to implement the barcoding portion of the project. This required the unit where she worked to release her time so she could do the project work; other unit members had to take up the slack during her absence (Interviews with two central library department heads).
NPL thought that its existing paper file of registered customers was too inaccurate to justify converting it into the computer system. Two task forces were formed to work in this area. The registration task force was charged with designing a new format for customer registration, including the forms to be used in gathering the information, and new library cards. The customer relations task force planned the circulation policies which would be entered into the ILS, and also the process of re-registering all of the library's customers. Other task forces were responsible for naming the system, and for choosing the furniture. These task forces were all established in the summer of 1990 (HWH, August 16, 1990).

As the implementation project moved forward other task forces emerged. The cataloging impact task force planned new working methods for the Processing Department, the PAC (public access catalog) task force designed the educational program for assisting customers as they used the automated catalog, and the ephemeral materials task force planned for handling those library materials which would not be included in the ILS database. These task forces were organized in February, 1992 (HWH, February 28, 1992). A circulation training group was also formed in July 1992. This group received training from the system vendor at that time, and visited the Richmond Public Library to observe the system in use there. As the time for opening up the ILS for staff and
customer use approached, training activities were scheduled (HWH, July 31, 1992).

Training

Scheduling training presented problems for NPL. The tendency for the implementation to be delayed meant that there was a corresponding tendency to plan and deliver training too soon. This was not true in the case of the microcomputers, which were delivered and installed in a timely fashion, in the summer of 1990. At that time, NPL staff took advantage of City training opportunities to learn about microcomputers, the DOS operating system, and the WordPerfect word processing application (Memorandum to NPL supervisors and administrative staff from the Automation Project Manager, August 2, 1990).

Delivering training too far ahead of implementation meant that trainees could not practice their new knowledge on the ILS for some time. During this interval the new knowledge decayed, and was often entirely lost by the time implementation caught up (Interview with a branch library manager). In addition, the way NPL selected trainees, and the way it sought to deliver training while keeping the library operating compounded the problem. Trainees were selected on the premise that they would return to their departments and branches and proceed to train the staff who had remained behind. This trickle down approach to training led to unevenness of training between branches and
departments. In addition the increasing pressure of work resulting from staffing cuts meant that trained staff had less time available when they could share knowledge with their peers.

Scheduling training while keeping the library open made it harder for potential trainees to attend training sessions. Staff at NPL regarded the neighboring cities with envy (Interviews with a branch library head, a central library professional, and a central library non-professional); in those cities the public libraries closed their doors when they delivered training.

NPL staff at all levels emphasized the importance of training. Some were very critical of how training was handled during ILS implementation (Interviews with a branch library head, a branch non-professional, and a central library non-professional). The administrators who were responsible for training were convinced of its importance, and expressed frustration at how difficult it had been to deliver effectively (Interviews with two central library administrators). While training activities were under way in preparation for opening up the system, the final stage of database preparation, barcoding, was under way.

**Barcoding**

Although the barcoding task force was appointed in August, 1990 (HWH, August 16, 1990), the problems that delayed the creation of the bibliographic and item
components of the database had the effect of delaying barcoding work until October, 1991 (Norfolk Public Library, Va. Annual report, 1992). Barcode reader equipment was received in September, 1990 (HWH, September 12, 1990). In March, 1991, the barcoding task force, with assistance from the City Department of Communications, produced a mascot, slogan, and logo for their project. These were to be used on posters, which would notify the public of the work in process, and also on buttons, which would be worn by barcoding workers. The mascot was a bear, and the slogan was, "Please B'ar With Us...Barcoding In Progress" (HWH, March 11-April 3?, 1991).

The smart barcodes were received in June, 1991 (HWH, July 1, 1991), and applicants for the temporary barcoding positions were interviewed in August, 1991 (HWH, August 22, 1991). Also in August, the barcoding task force issued a call to the NPL departments and branches, requesting that the shelves be read. This was intended to make sure that all the items on the shelves were arranged in the correct sequence, making it easier for the barcoders to find items and match them to barcode labels.

In October, 1991, barcoding work began at the central library (Norfolk Public Library, Va. Annual report, 1992). The work at the central library finished in March, 1992, and moved on to the branches. The phone line to the Larchmont branch, which was installed on March 25, 1992, was available.
just in time to help the barcoders in their work at that branch (HWH, April 2, 1992). In January, 1993, the barcoders finished applying the smart barcodes (HWH, January 15, 1993). Barcoding work continued using dumb barcodes until June, 1993 (HWH, June 25, 1993), when the funding for the temporary workers expired. Even though the barcoding project was completed, many items were missed and so were not barcoded (Statement by NPL staff member on reviewing the draft report). Barcoding was the final step required to make the bibliographic and item components of the NPL database operational. Barcoding linked these two components within the computer, and also made a physical link with the materials on the shelf. Completion of the barcoding process was a necessary condition for implementing the circulation module of the ILS throughout the NPL system.

Linking the Branch Libraries to the System

Although the Processing Department at the central library had been using the ILS for cataloging since March, 1991, the system was not made available for production work in other departments until September 21, 1992. On that date the circulation module of the ILS began to be used at the central library. At the same time, the ILS began to be used to register customers (HWH, September 8, 1992). This meant that the microcomputer based customer registration program could be phased out. Plans were now made to quickly install the circulation module in the branch libraries. The plan
was to schedule training in a pair of branches each month, followed immediately by release of the circulation module for use in those branches (HWH, January 15, 1993). This plan was successfully implemented from January to June, 1993 (HWH, June 25, 1993). The circulation system, considered the "flagship module" by the automation project manager because of its visibility to the public, was now in use throughout the NFL system.

In April, 1993, NPL celebrated National Library Week by setting up ten public catalog (PAC) terminals at the central library. This was coordinated with an open house for the Friends of the Library group (HWH, April 12, 1993). By June, 1993, the PAC was available for use in the branches. In July, 1993, the first computer produced overdue notices were mailed to customers (HWH, June 25, 1993). On October 12, 1993, the City Council formally introduced the PAC to the community in a ceremony at the central library (HWH, September 23, 1993; Norfolk Public Library, Va. Annual report, 1993).

The discussion to this point has focused on ILS implementation. No mention has been made of the establishment of a new department, the Automation Department. That department is the subject of the following section.
Automation Department

When NPL first committed itself to the ILS there was little realization of what would be required in terms of running a computer system. The idea that the head of the Processing Department could add running the computer to his other duties was seriously considered (Interview with a central library department head). As NPL encountered the reality of ILS implementation, opinions changed, and it was understood that it would be necessary to assign staff who would be totally committed to automation activities. Eventually, the Automation Department would have a staff of four.

In running a computer system a myriad of details must be attended to, above and beyond the implementation activities already described. The physical setting, which includes air and electric power conditioning, a fire control system, and a secure area, must be maintained. Hardware and software operations must be monitored. When problems arise they must be diagnosed and serviced. Data must be backed up on a carefully planned schedule. Hardware and software upgrades must be scheduled and performed. User requests and problem reports require attention. Procedures must be documented in detail, so that staff can cover in areas which are not their main expertise. The computer runs 24 hours a day, seven days a week, producing a higher expectation of continued performance than would be the case in an un-
automated library (Interview with a central library department head).

The first position filled in the Automation Department was that of the automation project manager herself. In July, 1991, the position of system manager was created and filled (HWH, July 1, 1991). The responsibilities of this position included handling many of the details described in the preceding paragraph. In June, 1992, the position of computer operator was created and filled (Norfolk Public Library, Va. Annual report, 1992). This position was responsible at first for the tedious late night work of running backups to magnetic tape. Later, when NPL acquired more powerful backup equipment, this person was able to work to support user assistance activities. The final position in the Automation Department was that of the microcomputer technician, which was filled in February, 1994. This position was initially responsible for supporting NPL staff use of microcomputers, and for servicing terminals and printers at the various library sites. The person who filled this position was able to exercise some initiative by writing some labor saving scripts for the VAX computer, and working to get public dial access to the PAC into service (Interview with a central library department head).

The Automation Department also experienced some staff turnover. In December, 1993, the system manager resigned, and in August, 1994, the automation project manager retired.
from NPL. Her position was later filled under the title of automation manager, symbolizing the impending completion of the ILS implementation project. Once the circulation and PAC modules had been successfully brought into use, implementation turned to those ILS features which had not yet been addressed.

Implementation Afterthoughts

NPL had brought up the circulation and PAC modules of the ILS, and before that had begun using the cataloging module. The database of customers, bibliographic records and item records had been built, and barcoding completed. The customers were re-registered in the new system. However, several other ILS components remained unimplemented, such as dial access, reserve, acquisitions, periodicals, and facilities booking (Interview with a central library administrator). Attention now turned to these unimplemented modules, which had been purchased in 1990 only to sit on the shelf.

No task forces were convened to help with these efforts. The Automation Department, with a staff of four after February, 1994, took the initiative. Dial access to the PAC, which allowed customers to connect with the PAC over the public phone system from home using their personal computers, was made available in February, 1994. In May, 1994, the reserve module, which allowed customers to put holds on items which were checked out, began to be used.
During the summer of 1995 the acquisitions module, which manages the purchasing of library materials, came into service. As the interview portion of this research was underway, in November 1995, the database interface module of the ILS was being implemented. This interface module permits NPL to provide access to external databases through the PAC, which greatly increases the range of resources available to PAC users.

During this period where the ILS implementation project seemed to be winding down, the long time director of NPL resigned, in August, 1994. It took a year to find her replacement; the new director began work in August, 1995. One of the main challenges facing the director of NPL, whether former or present, is the constrained budget situation of the City of Norfolk. Although the City was able to find money to buy the ILS, money became significantly tighter as the implementation went forward. As NPL implemented their ILS a variety of stratagems and techniques were adopted to cope with difficult times. In the following section these coping techniques and strategies are described.

**Administrative Responses to Downsizing**

Staff reductions at NPL elicited a variety of responses from the library's administration. The shrinking staff size meant that the labor resource available to carry out current operations was decreasing over time. At the same time,
computerization demanded a great deal of staff effort, and eventually four precious staff positions were dedicated to the Automation Department.

The effect can be clearly seen in the change over time in the number of staff appointed to task forces. Before the ILS was selected in 1988, NPL had an Automation Committee of 15 members, plus three task forces, each with 13 or more people (HWH, June 28, 1988). When three task forces were appointed in February, 1992, the largest consisted of four people (HWH, February 28, 1992).

When staff served on task forces for ILS implementation, the remaining staff had to cover for them. This was required by NPL’s practice of keeping the library doors open. "I think trying to balance the day to day operations while we came fully aboard was a price that the staff paid. . . . we did things very incrementally over a long period, as opposed to completely in a short period, and that was due to the manpower available to us" (Interview with a central library administrator). One class of measures NPL administration took to cope with staff reductions were reorganizations; these changes are described in the next section.

Reorganization

One reorganizing strategy adopted by NPL was to withdraw staff resources from the branch libraries to the central library. To do this, branch libraries were stripped
of professional staff. Branches were grouped into pairs, and each pair was managed by a single professional; this arrangement was in place early enough to be reported in the 1992 American Library Directory. All other branch staff were support staff. Branches frequently operated with only two staff on duty at a given time (Interview with a branch library head).

At the central library a succession of departmental mergers took place. By summer 1995 the General Reference Department had absorbed the former Fiction, Audio-Visual, Circulation, and Business, Technology, & Social Science (BTSS) Departments. The merger of the Audio-Visual department took place in summer, 1993, after the head of that department retired that June. The merger with Circulation and BTSS took place in summer, 1995. At this point the General Reference Department was renamed as the Information Department (Interview with a central library department head).

Responsibility for upkeep of NPL's physical plant was taken over by the City. The NPL's custodial work force was transferred to the City General Services department (Interview with a branch library head). In addition to reorganizing, NPL administration tried to make the ILS pay off as quickly as possible, as described in the following section.
Scheduling ILS Module Implementation

NPL administration scheduled the order of implementation of ILS modules so as to expedite the realization of staff saving through system efficiencies. "The sequence that the Norfolk Public Library system elected to use in implementing modules concentrated primarily on the internal processes, so that by gaining the efficiencies . . . that are part of an automated system, we could then take that staff person, . . . and divert them to public service" (Interview with a central library administrator).

The choice of the cataloging module as first to be implemented can be justified on technical as well as administrative grounds; cataloging activities are essential for the successful functioning of the other ILS modules. It was the selection of the circulation module as next to be implemented that fit NPL's need for internal efficiency. In addition, the public visibility of the circulation module had the potential for garnering community support (Suggestion made by an NPL staff member after reviewing this report in draft form).

The organizational climate that resulted from staff cutbacks was characterized by anxiety and mistrust. To counter this, NPL administration supported morale boosting efforts, as described in the following section.
Morale Boosting

Efforts were made to keep up staff morale. Use was made of in house news flyers, such as the "Here’s What’s Happening!" flyer which kept staff informed of the progress of the ILS implementation. Hoopla as a way of generating staff excitement and involvement was demonstrated by the use of a mascot and slogan by the barcoding team.

Participation by staff in task forces was an essential contribution to the ILS implementation, but it also had the effect of reinforcing staff involvement. "... there were a number of task forces that were put in place, again using everyone we had in house, so that level of participation was ... exciting, I mean, people got involved because they were who we had when we needed them. .... All the staff did that. ... so the ownership part was probably at a very strong level, because they had been so intimately involved with everything" (Interview with a central library administrator).

Even so, a climate of anxiety and mistrust grew among NFL staff. These feelings were directed at the NFL and City administrations. One interviewee commented to this researcher that many staff members had thought him a spy for administration when the research began (Interview with a branch library non-professional). With the arrival of a new NFL director in August, 1995, this negative climate seemed to be diminishing. Some of these negative feelings may have
resulted from the various actions that NPL administration took to manage staff positions. These actions are discussed in the following section.

Managing Positions

Some positions ceased to exist. It seems that three factors may have mitigated the impact of this on the individuals who occupied these positions. The first factor was the value placed on seniority by Civil Service regulations. One interviewee told a story of being transferred to another City department in 1990, only to be transferred back to NPL a year later. The second mitigating factor was that some lower level staff who were apprehensive of computerization chose to resign (Interview with a central library administrator), which meant a reduction in the number of individuals who had to be designated for termination. The last factor was the practice of moving staff who would otherwise have been terminated into newly created positions, such as those in the Automation Department (Interview with a central library department head). However, despite these mitigating factors, many staff were simply let go.

To avoid increasing salaries for the positions which remained, NPL administration avoided job reclassification as much as possible. Job descriptions were modified in a minimal way to include language describing computer related skills, such as keyboarding ability. Some job
reclassification did occur, but it was limited to the Automation Department and the Business Office (Interviews with three central library administrators and one department head). NPL staff characterized the effect of computers on their jobs by saying that their responsibilities remained the same, while at the same time the methods and procedures they used to perform their jobs changed.

In order to adjust to computerization without reclassifying jobs, NPL engaged in two types of tinkering with jobs. Those people who were perceived as trainable, or as already having some computer related skills, were moved into jobs which fit them well. The opposite type of tinkering also occurred, with jobs being changed to fit the people who occupied them.

Looking toward the NPL workforce of the future, NPL administration planned to stop hiring in the lower classifications, and to instead hire only those more educated workers who fit the vision of a new, more highly skilled and educated staff (Interview with a central library administrator). This plan could not effect change in existing staff, but it could begin to shift the balance toward a more highly educated work force.

Department and branch heads carried out the task of fitting individuals to computerized jobs. This resulted in there being some variety in approaches used in different departments. Some supervisors followed an efficiency
oriented approach, while others were more concerned with motivating staff to perform well. The general approach was summed up in the following exchange during one of the interviews: "(Interviewer: It seems that you’re saying that people just adjusted through the course of events . . . ). That’s what we did. (Interviewer: As something impacted them, they would flex, to accommodate it). That’s what we did, and we’re still doing it" (Interview with a branch library head).

Having professional department heads take care of the task of fitting the worker to the newly computerized job was consistent with the norms of the library profession (Reeves, 1980). It was also consistent with the NPL administrative strategy of avoiding reclassification. Although in this case NPL administration acted in accordance with professional norms, they did not always pay attention to them. The following section discusses changes in assumptions at NPL regarding the division of labor between professionals and support staff.

Changes in the Division of Labor

Computerization with an ILS succeeded in absorbing much of the routine work associated with the previous work systems. For example, paper catalog cards were no longer filed for hours in the card catalogs. The result was a freeing of support staff time, which was then available for other activities. Interviewees were in agreement that
computerization meant that staff could spend more time in working with the public and on preparing programs.

Professional norms have suggested that the work performed by professional librarians should be different from the work of other library workers. Professional work should be more complex, and should involve the exercise of judgment based on graduate education in librarianship. In addition, professionals should have authority over the work of other library staff (Reeves, 1980). Computerization tended to obscure this distinction. One interviewee stated, "... they've always tried to have ... a dividing line as to what professionals were doing as what would the support staff would do. Downsizing has sort of erased that line" (Interview with a central library professional).

Another interviewee had this to say, "It empowered the support personnel, and ... caused organizational changes for the professional ... [they were] presented with something for which they had had no training, and in most cases no background. I don't feel the support staff thought of it as a threat, and the professional staff did. And what I mean by threat, is threat to the established order, and the traditional way of doing things" (Interview with a central library non-professional).

As support staff time was freed from the routine of the old system, many of the tasks assigned to them were ones which had previously been considered as characteristically
professional. Examples of the tasks include cataloging and reference. The norms of librarianship require that non-professional staff be supervised by professional level staff, but NPL administration allowed the central library processing department to be without any professional staff for a year and a half. After the processing department head retired in June, 1993 (HWH, June 25, 1993), there were no professionals in this department until a former reference librarian was assigned to manage the department early in 1995 (Interviews with a central library department head and with a branch head).

When interviewed, NPL staff stated that they perceived little difference between the work done by professionals and support staff. This was especially true in the branch libraries. However, this perception was not uniformly held. Some interviewees, even though they acknowledged that support staff work had been upgraded, and that previously professional duties were now given to support staff, still saw a difference. These respondents thought that professional work remained more complex than support staff work.

After all of the adjustments were made at NPL, did the jobs which resulted differ from earlier versions of the same jobs, or from jobs in other public libraries? In the next section questionnaire data gathered at NPL is compared with data gathered through the mail survey.
Questionnaire Data Analysis

Questionnaire data gathered at NPL in June, 1995, is used here to address two questions. One question asks if the data reveals a difference between jobs at NPL before and after computerization. The other question asks whether jobs at NPL are similar or different from jobs held by Virginia public librarians in general.

Job Characteristics Before and After Computerization

In June, 1995, NPL staff responded to questionnaires which used the three MJDQ subscales to ask about the characteristics of their jobs. Two forms of questionnaire were administered; one form asked about jobs in 1990, the other about jobs at the present time. T-tests for independent samples were used to analyze the response data. A separate test was made for each subscale. The results of the t-tests are presented in table four.

Using a significance criterion of $\alpha = .05$, two-tailed, all tests resulted in non-significant results. The data do not support an inference that job characteristics at NPL in 1990 differ from present job characteristics. The right column of table four shows the $\beta$ value for each of the tests; this value is the probability of a false negative result. A $\beta$ value of .20 is normally considered acceptable (Cohen, 1988). Thus, these tests are doubly inconclusive. Not only do they fail to reach statistical significance,
they also lack the statistical power to achieve significance.

Table 4
T-tests of MJDQ Before and After Data from NPL

<table>
<thead>
<tr>
<th></th>
<th>T</th>
<th>p</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivational</td>
<td>-0.5805</td>
<td>.56</td>
<td>.92</td>
</tr>
<tr>
<td>Mechanistic</td>
<td>-0.8267</td>
<td>.41</td>
<td>.90</td>
</tr>
<tr>
<td>Perceptual/Motor</td>
<td>-1.5818</td>
<td>.12</td>
<td>.74</td>
</tr>
</tbody>
</table>

df = 33

Although this data does not support a before and after comparison within NPL, it is still of some use for comparing job characteristics at NPL with the job characteristics of respondents to the mail survey. In the next section some of the NPL data is compared with mail survey data.

NPL Jobs Compared With Virginia Jobs

An analysis was performed to compare MJDQ data from NPL with data from the mail survey. Fifteen NPL staff replied to the current version of the questionnaire, and data from their responses was included in this analysis. Data from twenty other NPL staff who had responded to the 1990 version of the questionnaire was not included in the analysis.

Establishing a link between the case study and the mail survey requires establishing similarity between the data from the two research settings. The most straightforward approach to establishing similarity would be to compute correlation coefficients, but the different group sizes make direct computation difficult. However, it is possible to
obtain a correlational measure of the similarity of the groups using an indirect approach. This approach begins with a t-test for independent samples.

T-tests for independent samples were carried out for each of the MJDQ subscales, comparing the data from 15 NPL staff with data from 221 respondents to the mail survey. Data from these t-tests is presented in Table 5.

<table>
<thead>
<tr>
<th>T-tests of NPL After Data and Mail Survey Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Motivational</td>
</tr>
<tr>
<td>Mechanistic</td>
</tr>
<tr>
<td>Perceptual/Motor</td>
</tr>
</tbody>
</table>

These tests indicate no significant difference between the NPL data and the mail survey data for either the motivational or the mechanistic subscales of the MJDQ. However, NPL data for the perceptual/motor subscale does differ significantly from the mail survey data. NPL staff scored lower than did mail survey respondents on this subscale of the MJDQ. Because low MJDQ scores indicate high levels of job characteristics, and jobs with high perceptual/motor characteristics are undemanding, this indicates that NPL jobs are somewhat less demanding than jobs in the survey population. Because of this statistically significant result, no argument for similarity

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is possible as far as perceptual/motor job characteristics are concerned.

Cohen (1988, p. 23-24) shows how point biserial correlation coefficients can be computed from standardized differences of group means. Point biserial correlation coefficients derived using Cohen's method are shown in the right hand column of Table 5, under the heading \( r_p \). The point biserial method is used to compute correlations between a continuous variable and a binary categorical variable. In this case MJDQ subscale scores are the continuous variable, and membership in the groups of NPL respondents or mail survey respondents is the binary categorical variable.

Point biserial coefficients can be interpreted as the effect that scores on a continuous variable have on the probability of membership in one of the two groups. In this case, the small size of these coefficients indicates that MJDQ scores have little effect on whether an individual is a member of the NPL staff or of the mail survey group. An alternative interpretation is that group membership has little effect on the MJDQ subscale scores. Both interpretations support an argument of similarity between the two groups. This similarity is only found with two of the three MJDQ subscales, the motivational and mechanistic subscales. In the next section the analysis of the MJDQ data relating to the case study is summarized.
Summary of MJDQ Data From the Case Study

The comparison of before and after MJDQ data was not statistically significant, and therefore the evidence for change in job characteristics at NPL during the period of computerization, as measured with the MJDQ, is inconclusive. The comparison of NPL questionnaire data with mail survey data provides mixed results. The perceptual/motor subscale data indicated that jobs at NPL were significantly different from the jobs of Virginia public library workers in general for this job model. On the other hand, the data for the motivational and mechanistic subscales indicated that jobs at NPL were similar to the jobs of Virginia public library workers in general for these other job models.

As recommended by Yin (1994), a draft of the first three sections of the report, consisting of budget and staffing, implementation history, and administrative reactions, was given to an informant who works at NPL for review. This review is discussed in the following section.

Review by an Informant from NPL

Review of a draft case study report by internal informants is recommended by Yin (1994) as a way of strengthening construct validity. The identity of the reviewer used in this research is kept confidential. The reviewer made few comments about the factual accounting in this report. Two changes in emphasis were made as a result
of reviewer comments. After reviewing the draft report the
reviewer made the following comment:

Seven years passes quickly, though the pain of this
period of NPL history is only partially reflected in
this study. The exchange (sacrifice) of manpower for
automation is certainly obvious, and actually more so
when looking at the figures from the outside rather
than within -- when it seemed that some other city
departments have also suffered, while the city
administration worked to cut total positions by 700
during this period.

This concludes the analysis of the case study data. In
the following section the data from the mail survey is
analyzed.

Mail Survey Analysis

The mail survey component of the research uses
multidisciplinary job characteristics theory (Campion, 1988;
Campion & Thayer, 1985, 1987) to investigate the effect of
computerization on the jobs of survey respondents. Use of
constructs and instruments from organizational science
disciplines is recommended by Zmud and Boynton (1991) as a
way of producing stronger results from research into the
organizational effects of computing; this research follows
their recommendation.

Multidisciplinary job characteristics theory seeks to
integrate four job models which derive from different
disciplines. In this research three of these job models are investigated. Motivational job design is based in the discipline of organizational psychology; it seeks to make jobs more rewarding for workers. Mechanistic job design derives from classical industrial engineering, and tries to simplify work processes to improve efficiency. Perceptual/motor job design stems from human factors research, and seeks to make job performance more reliable by making the work itself less mentally demanding (Campion & Thayer, 1987). These three job models are used in the mail survey as indicators of the effects of computerization on jobs.

Other data gathered by the mail survey relates to computerization, professional and functional status, and several control variables for library size, job level, seniority, gender, and age. In the remaining portion of this chapter the data from the mail survey is described and analyzed.

**Description of the Mail Survey Data**

In this section the mail survey data is described. To facilitate the presentation, the data relating to the presence of different ILS modules is reviewed first. Next, a principal components analysis is presented which supports combining ILS presence data into two variables for entry into multiple regression analyses. This is followed by a review of the remaining independent variables. Next, a
method variable which is used to capture the effect of the mail survey is described. Finally, descriptive statistics for the data from the three MJDQ subscales are reviewed.

Presence of ILS Modules

The first item on the survey instrument requested respondents to indicate if any of a potential eight ILS modules (Johnson, 1991) were currently in use at the library where they worked. Thus, individual scores for this item could range from zero to eight. The responses are shown here in table six.

Table 6
ILS Modules Reported by Mail Survey Respondents

<table>
<thead>
<tr>
<th>ILS Modules</th>
<th>Percent</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Catalog</td>
<td>79</td>
<td>174</td>
</tr>
<tr>
<td>Circulation</td>
<td>84</td>
<td>184</td>
</tr>
<tr>
<td>Cataloging</td>
<td>80</td>
<td>177</td>
</tr>
<tr>
<td>Accounting</td>
<td>37</td>
<td>81</td>
</tr>
<tr>
<td>Acquisitions</td>
<td>60</td>
<td>131</td>
</tr>
<tr>
<td>Collection Development</td>
<td>32</td>
<td>71</td>
</tr>
<tr>
<td>Serials</td>
<td>30</td>
<td>65</td>
</tr>
<tr>
<td>Binding</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

N = 220

The first column of table six identifies the eight different ILS modules. The second column shows what percentage of respondents answered in the affirmative regarding the current use of that module in the library where they worked. The third column shows the absolute
frequency of affirmative responses among the 220 respondents.

It is important to note that this data is individual level data, and therefore cannot be used to make inferences about the incidence of ILS use in Virginia libraries. One can say that 79 percent of Virginia public library workers are employed in libraries that use a computerized public catalog, but not that 79 percent of Virginia libraries use this ILS module.

The data shows that roughly four out of five Virginia public library workers are employed in libraries where circulation, the public catalog, and cataloging are computerized with an ILS. Three out of five library workers work in libraries with ILS acquisitions modules. Other ILS modules are present in the workplaces of fewer than half of Virginia library workers.

ILS bindery modules are reported to be the workplaces of only three percent of workplaces. This is a puzzling result, as one would expect the incidence of this module to parallel that of serials modules. One possible explanation is that bindery functions may be sold to libraries as part of a serials module; this might have led respondents to answer negatively even if bindery functions were present in their library.

The data for presence of ILS modules raises the issue of how it should be analyzed. If it is scored as the sum of
affirmative responses it will lead to situations where identical scores are likely to have different meanings. Thus, a score of three for a respondent may mean that person works in a library with a public catalog, circulation and cataloging, while the same score for another respondent could mean that the second person works at a library with a different set of three ILS modules installed. This issue was addressed using a principal components analysis, as described in the following section.

**Principal Components Analysis of ILS Modules Data**

Principal components analysis is a descriptive data reduction method which can transform a set of variables to a smaller number of orthogonal components (Dunteman, 1989). In this research it was used to address the issue raised by the data on presence of individual ILS modules. The mail survey data was subjected to a principal components analysis with varimax rotation. Sixteen components with eigenvalues of one or higher emerged from the analysis. A criterion of .5 was used to identify which survey items loaded on to the 16 principal components.

Three components were found to account for the ILS module presence data. The remaining components consisted either of MJDQ subscales, or of single or double item components which could not be readily interpreted. The components which do not relate to ILS module presence scores will not be considered further.
The two principal components which account for the ILS module presence data are shown in table seven. The first of these two components consists of the public catalog, circulation, and cataloging modules, together with the item for percent of time the respondent spent working with the ILS. The second component consists of four of the remaining five ILS modules: accounting, serials, acquisitions, and collection development. The eighth ILS module, bindery, loaded on to a third factor by itself.

Table 7

<table>
<thead>
<tr>
<th>Two Principal Components of Integrated Library Systems</th>
<th>Public Service Component</th>
<th>Backroom Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Catalog (OPAC)</td>
<td>0.80280</td>
<td></td>
</tr>
<tr>
<td>Circulation</td>
<td>0.73309</td>
<td></td>
</tr>
<tr>
<td>Cataloging</td>
<td>0.66672</td>
<td></td>
</tr>
<tr>
<td>Percent of time with the ILS</td>
<td>0.58248</td>
<td></td>
</tr>
<tr>
<td>Accounting</td>
<td>0.77447</td>
<td></td>
</tr>
<tr>
<td>Serials</td>
<td>0.68181</td>
<td></td>
</tr>
<tr>
<td>Acquisitions</td>
<td>0.65705</td>
<td></td>
</tr>
<tr>
<td>Collection Development</td>
<td>0.63625</td>
<td></td>
</tr>
<tr>
<td>Sum of Squared Loadings</td>
<td>2.72735</td>
<td>2.53351</td>
</tr>
</tbody>
</table>

The first of these two components was interpreted as "public service computing". If a library is to offer services to the public with an ILS, these three modules are the basic set which are required. The catalog and circulation provide the services, and cataloging is an essential support function for providing either of them.
The second component was interpreted as "backroom computing". The four modules in this component are not essential to provision of public services; instead they support library processes which are largely invisible to library users.

These two components provide an attractive way of scoring the ILS module presence data for analysis. Components from a principal components analysis can be used as variables instead of the original variables that load on them. In this case, the first component, public service computing, substituted for data on the presence of a public catalog, circulation, or cataloging modules. The second component, backroom computing, substituted for data on the presence of accounting, acquisitions, collection development, and serials modules.

When used for later analysis, the variable for time spent with the ILS was not included in the public service computing component. The original research design had conceptualized the extent to which ILS is present as a separate variable from the extent to which ILS was used by the respondent. ILS module presence is a function of the library worker's workplace environment, while time spent with the ILS is a direct function of the worker's job. Combining these two would lose information present in the data set, and would foreclose any possibility of learning if these variables had different effects. For these reasons,
the variable for time spent with ILS was kept separate from the public service computing component in later analyses.

The third component which related to ILS modules consisted solely of the bindery module, and is not shown in table seven. The data relating to this variable are puzzling, as noted earlier. The other two ILS module components account for most of the useful information in the data set. From a data analytic perspective the data for the bindery variable is skewed, and might therefore have exaggerated effects on the outcome of multivariate analyses. For these reasons the data for the bindery module of ILS was not included in later analyses.

The presence of ILS modules is one of several independent variables gathered by the mail survey. In the following section the data for the other independent variables is examined.

**Independent Variables Other Than ILS Modules**

Data for the remaining mail survey independent variables is summarized in table eight.

Mail survey respondents were asked whether or not their job required possession of a graduate library degree. This is a measure of whether or not the job is professional in character. 76 percent of the respondents indicated their jobs were professional. The absolute frequency of affirmative responses was 167 of 220.
Table 8

<table>
<thead>
<tr>
<th>Independent Variables other than ILS Modules</th>
<th>Percent</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLS Degree Required</td>
<td>76</td>
<td>167</td>
</tr>
<tr>
<td>Female Gender</td>
<td>87</td>
<td>193</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>30</td>
</tr>
<tr>
<td>47</td>
<td>32</td>
</tr>
<tr>
<td>137</td>
<td>184</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>45</td>
<td>9</td>
</tr>
</tbody>
</table>

Because gender can influence job characteristics (Campion & Thayer, 1985), respondents were asked to indicate whether they were male or female. 87 percent of the respondents were female. The absolute frequency of female respondents was 193 of 221.

Two items on the survey instrument requested responses in percentages of total work time. One of these asked for the percent of total work time spent with the ILS, the other for percent of total work time spent working with the public. Percentage of time spent with the ILS is a measure of computerization. The mean percentage of time spent with ILS was 41, with a standard deviation of 30.

Percentage of time spent with the public is a measure of functional status. Public service staff should spend a higher proportion of their time with the public than do...
other staff. The mean percentage of time spent with the public was 47, with a standard deviation of 32.

Because organizational size has been found to be an important contextual variable in previous research (Gerwin, 1981; Miller et al., 1991), respondents were asked to state the number of people who work in the library system where they work. The word "system" was used in this item to make sure the respondent gave an answer which corresponded to the whole organization, rather than to only a part of the organization, such as the branch library where they work. The mean library size was 137, with a standard deviation of 184.

Supervisory status is a measure of job level, and a potential influence on motivational job characteristics (Campion & Thayer, 1985). Therefore, respondents were asked how many individuals they supervised. The mean number of people supervised by the survey respondents was eight, with a standard deviation of 18. However, 29 percent of the respondents replied that they did not supervise anyone, so it would be hasty to conclude that the survey population consisted mostly of supervisors.

The length of time a person has worked for an organization can potentially influence the characteristics of their job (Campion & Thayer, 1985). Survey respondents were asked how many years they had worked with the library
where they now work. The mean length of employment was nine years, with a standard deviation of seven.

A person's age can also potentially influence their job (Campion & Thayer, 1985; Kraut, Dumais & Koch, 1989), and so respondents were asked to provide this information. This item was anticipated to have some potential for offending respondents, and so it was placed last on the instrument. Only 208 of 221 respondents provided data for this item. The mean age was 45 years, with a standard deviation of nine.

The data for these independent variables was gathered through the explicit responses of the mail survey respondents. In the following section an implicit variable is described which seeks to control for the effect of the mail survey itself.

Controlling for the Effect of the Mail Survey

As described in chapter three, the mail survey involved a succession of four waves of mailings to prospective respondents. Because respondents were exposed to different combinations of method effects by the mail survey, method bias resulting from differences between response cohorts is a possibility. The numbers of responses in each cohort and the cumulative percentage of responses received are shown in table nine.
Table 9

Mail Survey Response Cohorts

<table>
<thead>
<tr>
<th>Mailing</th>
<th>Responses</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mailing 1</td>
<td>62</td>
<td>28</td>
</tr>
<tr>
<td>Mailing 2</td>
<td>114</td>
<td>80</td>
</tr>
<tr>
<td>Mailing 3</td>
<td>40</td>
<td>98</td>
</tr>
<tr>
<td>Mailing 4</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>221</td>
<td></td>
</tr>
</tbody>
</table>

The potential for bias takes two forms here. One of these is the effect of the mail survey itself. It is possible that the response of someone who has only received the cover letter which accompanied the first mailing might differ from that of someone who has also received the followup postcard plus the different cover letter which accompanied the third mailing. This potential bias corresponds to the threat to internal validity which Campbell and Stanley (1963) identify as instrumentation.

Another possibility is that there are unknown systematic differences between the responses of those people who respond immediately to surveys and the responses of those who wait until after they have received repeated requests. Both of these potential biases can be controlled by creating a method variable and entering it into the analyses.

This method variable is defined for this research as an ordinal scale with a range of one to four. Respondents in the first cohort, who replied before receiving the postcard
follow up, are coded with the value one. Those in the second cohort are coded two, those in the third cohort are coded three, and those in the last cohort are coded four.

In addition to independent variables, the mail survey also gathered data for the dependent variables. This data for the dependent variables is reviewed in the following section.

**MJDO Subscale Data**

The dependent variables in the mail survey component of the research are three subscales of the MJDO. These are the motivational, mechanistic, and perceptual/motor subscales. Data from the mail survey on these subscales is shown in table ten. The first column of table ten identifies the subscale, the second column give the mean raw score, the third column the standard deviation of the raw score, and the right hand column the mean subscale score. Each subscale has a different number of items. The motivational subscale has 18 items, the mechanistic has eight, and the perceptual/motor has 12 items. The mean subscale score is calculated by dividing the raw mean score by the number of items in the scale.

<table>
<thead>
<tr>
<th>MJDO Dependent Variables</th>
<th>raw mean</th>
<th>SD</th>
<th>scale mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivational</td>
<td>38.37</td>
<td>8.67</td>
<td>2.13</td>
</tr>
<tr>
<td>Mechanistic</td>
<td>25.10</td>
<td>3.61</td>
<td>3.14</td>
</tr>
<tr>
<td>Perceptual/Motor</td>
<td>39.34</td>
<td>5.70</td>
<td>3.28</td>
</tr>
</tbody>
</table>
In the multivariate data analyses which follow the raw scores are used as the dependent variables. However, for the present discussion it is preferable to use the mean subscale scores, as these are proportionate to the number of items in the different subscales.

Subscale scores range from 1 to 5, with 1 being high and 5 low. In examining the mean subscale scores from the mail survey, it is clear that the jobs of the respondents score more highly on the motivational subscale than on the other two subscales. Similarly, the mean score on the perceptual/motor subscale is the lowest of the three subscales. These differences are suggestive, but should not be given too much weight. This is because the MJDQ subscales measure independent constructs, and no linkage exists between subscale values. One cannot say that a score of 3 on one subscale is equivalent to a score of 3 on one of the other subscales.

Previous research with the MJDQ has resulted in a characteristic pattern of correlations between data from the different subscales. This pattern has been characterized by positive correlations between the mechanistic and perceptual/motor subscales, and negative correlations between both of these subscales and the motivational subscale (Campion, 1988, 1989; Campion, Kosiak & Langford, 1988; Campion & McClelland, 1991; Campion & Stevens, 1989; Campion & Thayer, 1985).
Table 11

MJDO Subscale Correlations in the Mail Survey

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivational</td>
<td>1.0</td>
</tr>
<tr>
<td>Mechanistic</td>
<td>-0.086</td>
</tr>
<tr>
<td>Perceptual/Motor</td>
<td>0.276*</td>
</tr>
</tbody>
</table>

*p = .0001

The mail survey data (see table eleven) do not fit this pattern. Only one intrasubscale correlation is statistically significant. This is a positive correlation between the motivational and the perceptual/motor subscales. The direction of this correlation is the opposite of the direction reported in the literature. This finding suggests that job characteristics in the mail survey population are different from those in the populations studied previously using the MJDO.

The following section summarizes important points raised during the preceding review of the mail survey data descriptive statistics.

Summary Description of the Mail Survey Data

Survey data indicating the presence of eight ILS modules was found through principal components analysis to load on to two principal components. These components were interpreted as public service computing and backroom computing, and are used as variables in later analyses. Four out of five library workers are employed in libraries which have ILS public catalog, circulation, and cataloging modules; this combination of ILS modules corresponds to the
public service computing component. Three out of five workers are at libraries with ILS acquisitions modules. Less than half of library workers work at libraries having other ILS modules.

Three quarters of respondents have professional jobs, and 87 percent are female. An average respondent would spend 41 percent of her time working with the ILS and 47 percent of her time working with the public. This average respondent has worked for 9 years at a library where 137 people are employed, supervises eight people, and is 45 years of age.

A method variable was constructed to control for respondent mail survey response cohort membership. Entering this variable into multivariate analyses controls for this potential source of method bias.

Dependent variable mean scores are highest on the motivational subscale of the MJDQ and lowest on the perceptual/motor subscale. A significant positive correlation of .276 exists between the motivational and perceptual/motor subscale data. This intrasubscale correlation is not predicted by the literature; this may indicate that job characteristics in the survey population differ from those in the populations where the MJDQ has been previously used.

In the next section of this chapter the multivariate analyses used for hypothesis testing are described.
Analysis of the Mail Survey Data

The null hypotheses were tested using hierarchical multiple regression analysis (Tabachnick & Fidell, 1983). This analytical method allows a conservative hypothesis test by entering the set of control variables into the model first, and only then applying the hypothesis testing variables to the remaining variance.

Table 12
Hypothesis Test Outcomes for ILS Effect on Job Characteristics

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H1&lt;sub&gt;0&lt;/sub&gt;: Motivational Job Characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Public Service Computing</td>
<td>ns</td>
</tr>
<tr>
<td>Backroom Computing</td>
<td></td>
</tr>
<tr>
<td>Time with ILS</td>
<td>p &lt; .0452</td>
</tr>
<tr>
<td>Interaction of Public Service Computing with Time</td>
<td></td>
</tr>
<tr>
<td>Interaction of Backroom Computing with Time</td>
<td></td>
</tr>
<tr>
<td><strong>H2&lt;sub&gt;0&lt;/sub&gt;: Mechanistic Job Characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Public Service Computing</td>
<td>ns</td>
</tr>
<tr>
<td>Backroom Computing</td>
<td>ns</td>
</tr>
<tr>
<td>Time with ILS</td>
<td>p &lt; .0001</td>
</tr>
<tr>
<td>Interaction of Public Service Computing with Time</td>
<td>ns</td>
</tr>
<tr>
<td>Interaction of Backroom Computing with Time</td>
<td>ns</td>
</tr>
<tr>
<td><strong>H3&lt;sub&gt;0&lt;/sub&gt;: Perceptual/Motor Job Characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Public Service Computing</td>
<td>p &lt; .0001</td>
</tr>
<tr>
<td>Backroom Computing</td>
<td>ns</td>
</tr>
<tr>
<td>Time with ILS</td>
<td>ns</td>
</tr>
<tr>
<td>Interaction of Public Service Computing with Time</td>
<td>ns</td>
</tr>
<tr>
<td>Interaction of Backroom Computing with Time</td>
<td>ns</td>
</tr>
</tbody>
</table>
Two regression models were specified for these analyses. The first model tested for ILS effects on job characteristics. The outcomes of these hypothesis tests are summarized in table 12.

The analytical results shown in table 12 support rejection of the three null hypotheses relating to ILS effects on jobs. This allows acceptance of the alternative hypotheses, that computerization with an ILS does affect library job characteristics. However, different measures of ILS effects produce this result with the different job models.

Table 13
Hypothesis Test Outcomes for Moderator Variable Effects on Job Characteristics

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent Variable</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>H40</td>
<td>Professional Status</td>
<td>ns</td>
</tr>
<tr>
<td>H70</td>
<td>Functional Status</td>
<td>p &lt; .0346</td>
</tr>
<tr>
<td>H100</td>
<td>Interaction of Professional &amp; Functional Status</td>
<td>ns</td>
</tr>
<tr>
<td>H50</td>
<td>Professional Status</td>
<td>ns</td>
</tr>
<tr>
<td>H80</td>
<td>Functional Status</td>
<td>ns</td>
</tr>
<tr>
<td>H110</td>
<td>Interaction of Professional &amp; Functional Status</td>
<td>ns</td>
</tr>
<tr>
<td>H60</td>
<td>Professional Status</td>
<td>p &lt; .0005</td>
</tr>
<tr>
<td>H90</td>
<td>Functional Status</td>
<td>ns</td>
</tr>
<tr>
<td>H120</td>
<td>Interaction of Professional &amp; Functional Status</td>
<td>ns</td>
</tr>
</tbody>
</table>

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The second analytical model tested those null hypotheses which relate to the moderating effect of professional and functional status. The outcomes of these hypothesis tests are shown in table 13.

The results of the hypothesis tests shown in table 13 are limited in scope. Only two of nine null hypotheses are rejected. The interaction of professional and functional status had no effect on any of the three job models. Mechanistic job characteristics are unaffected by any of the three potential moderating variables. The other two job models, motivational and perceptual/motor, are each affected by a different moderating variable.

Not shown in tables 12 and 13 are two unpredicted analytical findings. In one of these the variable job level was found to have an effect on mechanistic job characteristics. In the other unpredicted finding the mail survey method was found to affect perceptual/motor job characteristics.

The results of the multiple regression analyses are diagrammed in figure three. In the following sections the details of these analyses are reviewed as they affect each of the three job design models. The failure to reject seven of nine null hypotheses is also discussed. First, the analyses as they relate to motivational job characteristics are reviewed.
Figure 3. Effects of Computerization and Moderator Variables on Three Job Design Models.
Motivational Job Model

The results of the hierarchical regression hypothesis testing for ILS effects on motivational job characteristics are shown in table 14.

Table 14

<table>
<thead>
<tr>
<th>Motivational Job Characteristics Are Affected by ILS</th>
<th>coeff</th>
<th>p</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>33.3042</td>
<td>.0040</td>
<td>.0359</td>
</tr>
<tr>
<td>Time with ILS</td>
<td>0.0611</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backroom Computing</td>
<td>-0.8230</td>
<td>.0452</td>
<td>.0169</td>
</tr>
</tbody>
</table>

$F(12,206) = 2.95 \quad p < .0008 \quad R^2 = .1465$

Table 14 shows only those hypothesis testing variables which had statistically significant results in the multiple regression analysis. The most important statistic reported in table 14 is the squared semi-partial correlation coefficient, $sr^2$. This statistic represents the proportion of the variance of the dependent variable that is accounted for exclusively by the independent variable (Tabachnick & Fidell, 1983).

The results of the hierarchical regression hypothesis testing for moderator variable effects are shown in table 15.

Table 15 is similar to table 14 in format. The significance tests for the whole regression model are reported on the bottom line of each table. The differences between the two tables for these significance test statistics is because they represent two different
regression models. The regression model used for testing the effects of ILS (table 14) provided a better fit for the data, as measured by the coefficient of determination, $R^2$, than did the regression model used for testing moderator variables (table 15). This difference in fit between the two regression models was also found with the data analyses for the other two job models, mechanistic and perceptual/motor.

Table 15

| Functional Status Moderates the Effect of ILS on Motivational Job Characteristics |
|---------------------------------|--------|-------|
| coeff                          | p      | sr^2  |
| Intercept                      | 34.1450|       |
| Time with Public               | 0.0417 | .0346 | .0187 |

$F(10,208) = 3.40$ $p < .0004$ $R^2 = .1403$

Cohen (1988) classifies correlational results according to their effect size, a measure of "the degree to which the phenomenon is present in the population" (p. 9). By convention, Cohen suggest that a correlation of $r = .10$ is small, one of $r = .30$ is medium, and a correlation of $r = .50$ is large. These conventional labels are useful in discussing the substantive significance of correlational analyses. Thus, the largest semi-partial correlation squared presented here in the analysis for the motivational subscale data is $sr^2 = .0359$, for the time with ILS variable. Taking the square root of this produces a result of $r = .1895$, a small to medium effect size. The effect
sizes for the other two variables which affect motivational job characteristics are both small (backroom computing, \( r = .13 \); time with the public, \( r = .1367 \)).

Figure four diagrams the effects of the statistically significant hypothesis testing variables on motivational job characteristics. Because MJDQ scoring is inverse, with low scores representing high levels of the characteristic being measured, the interpretation of the regression coefficients requires some care. For example, the proportion of time spent working with the ILS has a positive regression coefficient, indicating that as a worker spends a larger proportion of time with the computer their scores for motivational job characteristics can be predicted to increase also. However, higher scores indicate that the job is less well designed from the motivational perspective. Thus, the correct interpretation of this coefficient is that spending a greater proportion of time working with the ILS tends to reduce the motivating characteristics of jobs.

Similarly, the negative sign on the coefficient for the presence of backroom computing indicates that as this variable increases, scores for motivational job characteristics decrease. However, this decrease indicates an increase in the motivational characteristics of the job. Therefore, the correct interpretation of this coefficient is that jobs in libraries with more backroom computing tend to
Figure 4. Effects of Computerization and Moderator Variables on The Motivational Job Design Model.
have more highly motivating characteristics than do jobs in libraries with less backroom computing.

Finally, the coefficient for proportion of time spent with the public is positive, indicating that spending more time this way is associated with lower levels of motivational job characteristics. It is due to the inverse scoring of the MJDQ that the plus and minus signs in figures three and four are as they are. These signs do not reflect the signs of the regression coefficients, but rather they reflect the effects of the independent variables in increasing or decreasing the motivational characteristics of jobs. In the following section the analytical results for the mechanistic job model are described.

**Mechanistic Job Model**

In presenting the analysis for the mechanistic job model it is necessary to take into account an unanticipated finding. In table 16 the data from the full hierarchical multiple regression analysis for this job model is shown.

Presentation of this table provides an opportunity to discuss the hierarchical regression method further. As shown in table 16, this method involves entering the independent variables into the analysis in sets. In this analysis there were two sets, with the first consisting of the control variables, and the second set consisting of those variables which relate to hypothesis tests. The analysis for the mechanistic job model, shown in table 16,
produced an unanticipated finding for the people supervised variable. This variable operationalizes the construct of job level, which is thought to affect motivational job characteristics (Campion & Thayer, 1985). In this analysis job level was statistically significant (p < .0002).

Table 16
Regression Model for Testing ILS Effect on Mechanistic Job Characteristics

<table>
<thead>
<tr>
<th>Set of Control Variables</th>
<th>coeff</th>
<th>se</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>26.0452</td>
<td>1.5420</td>
<td>.0001</td>
</tr>
<tr>
<td>Time with Public</td>
<td>0.0078</td>
<td>0.0077</td>
<td>.3156</td>
</tr>
<tr>
<td>Library size</td>
<td>0.0007</td>
<td>0.0012</td>
<td>.5603</td>
</tr>
<tr>
<td>Non-professional status</td>
<td>-0.8504</td>
<td>0.5370</td>
<td>.1148</td>
</tr>
<tr>
<td>People supervised</td>
<td>0.0498</td>
<td>0.0132</td>
<td>.0002</td>
</tr>
<tr>
<td>Seniority</td>
<td>-0.0443</td>
<td>0.0330</td>
<td>.1812</td>
</tr>
<tr>
<td>Male Gender</td>
<td>-0.5182</td>
<td>0.6850</td>
<td>.4502</td>
</tr>
<tr>
<td>Age</td>
<td>0.0234</td>
<td>0.0287</td>
<td>.4163</td>
</tr>
<tr>
<td>Survey response cohort</td>
<td>-0.1670</td>
<td>0.2966</td>
<td>.5740</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set of Hypothesis Testing Variables</th>
<th>coeff</th>
<th>se</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Service Computing</td>
<td>NA</td>
<td>NA</td>
<td>.9585</td>
</tr>
<tr>
<td>Backroom Computing</td>
<td>-0.2078</td>
<td>0.1620</td>
<td>.2009</td>
</tr>
<tr>
<td>Time with ILS</td>
<td>-0.0372</td>
<td>0.0082</td>
<td>.0001</td>
</tr>
<tr>
<td>Public Service Computing X Time with ILS</td>
<td>0.0135</td>
<td>0.0084</td>
<td>.1094</td>
</tr>
<tr>
<td>Backroom Computing X Time with ILS</td>
<td>NA</td>
<td>NA</td>
<td>.7888</td>
</tr>
</tbody>
</table>

F(11,207) = 5.53  p < .0001  R² = .2272

The hierarchical regression method used for these analyses does not compute coefficients for those variables in the second set which have significance levels of p > .50,
nor does it compute squared semi-partial correlations for variables in the first set. These features of the analysis account for the "NA" entries in table 16, as well as for the fact that no squared semi-partial correlation coefficient is presented here for the job level variable.

The result of the hypothesis testing analysis for the mechanistic job model data is shown in table 17.

Table 17

<table>
<thead>
<tr>
<th>Mechanistic Job Characteristics Are Affected by ILS</th>
<th>coeff</th>
<th>p</th>
<th>sr^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>26.0452</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time with ILS</td>
<td>-0.0372</td>
<td>.0001</td>
<td>.0781</td>
</tr>
<tr>
<td>F(11,207) = 5.53 p &lt; .0001 R^2 = .2272</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This result has the largest effect size of all the analytic findings, with \( r = .2795 \). This can be considered a medium effect size according to Cohen's (1988) classification. Interpretation is similar to that with the motivational subscale data, as the MJDQ scoring is inverse here also. Therefore, this outcome can be interpreted as indicating that larger proportions of work time spent with the ILS, by leading to lower scores on the mechanistic subscale of the MJDQ, result in jobs with higher levels of mechanistic characteristics.

Figure five shows these relationships in diagrammatic form. Workers who spend more time with the ILS are more likely to have simplified and efficient jobs, while workers at higher job levels who have supervisory responsibility are
Figure 5. Effects of Computerization and Moderator Variables on The Mechanistic Job Model.
likely to have jobs with less of these characteristics. In the following section the analytic results for the perceptual/motor job model are described.

**Perceptual/motor Job Model.**

The analysis of the data for the perceptual/motor subscale of the MJDQ also produced an unanticipated finding. The method variable for mail survey response cohort produced a statistically significant result (p < .0372), indicating that some form of method bias was present. The results of the hierarchical regression analysis for testing the effects of computerization on perceptual/motor job characteristics are shown in table 18.

This result is the second largest effect size found in these analyses, with r = .26. This is close to the size of r = .30 which Cohen (1988) suggests is of medium size.

**Table 18**

<table>
<thead>
<tr>
<th>Perceptual/motor Job Characteristics Are Affected by ILS</th>
<th>coeff</th>
<th>p</th>
<th>sr²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>39.1154</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Service Computing</td>
<td>1.5650</td>
<td>.0001</td>
<td>.0676</td>
</tr>
</tbody>
</table>

\[
F(11,207) = 3.78 \quad p < .0001 \quad R^2 = .1672
\]

Once again the inverse scoring of the MJDQ makes careful interpretation necessary. Work in libraries with higher levels of public service computing will tend to have job characteristics with higher scores on the perceptual/motor subscale. However, higher MJDQ scores
indicate that these jobs have less of the characteristically perceptual/motor properties than do jobs with lower scores. In table 19 the result of the hypothesis testing of moderating variables is shown.

Table 19

<table>
<thead>
<tr>
<th></th>
<th>coeff</th>
<th>p</th>
<th>sr^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>38.3435</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Professional Status</td>
<td>-3.1150</td>
<td>0.0005</td>
<td>0.0497</td>
</tr>
</tbody>
</table>

F(10,208) = 4.06 p < .0001 R^2 = .1635

The variable shown in table 19 is categorical and consists of only two classes. Therefore, it is coded for entry into the regression analyses as a dummy variable. Dummy coding involves coding members of one group with the value zero and members of the other group with the value one. In this analysis professional respondents were coded zero and non-professional respondents were coded one. The interpretation of dummy variables in the case where there are only two groups is straightforward. The coefficient is interpreted as the difference between members of the group coded one and members of the other group (Hardy, 1993). The negative sign on the coefficient here indicates that workers with non-professional status tend to have lower perceptual/motor subscale scores than do workers with professional status. Once again, MJDQ scoring is inverse, which indicates that the jobs of non-professional workers

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have higher levels of perceptual/motor job characteristics than do professionals.

The results of the analyses for the perceptual/motor subscale data are diagrammed in figure six. The presence of public service computing and professional status both tend to make library jobs more demanding. These findings are consistent with findings from the literature (Johnson, 1991). In the next section the failure of the analysis to reject seven of nine null hypotheses relating to moderator variables is discussed.

**Retaining Null Hypotheses**

Why were seven of nine null hypotheses retained? The literature suggests that professional status (Reeves, 1980) and functional status (Chase & Tansik, 1984; Lynch, 1974; Perrow, 1967) will affect job characteristics. However, multidisciplinary job characteristics theory and previous research using the MJDQ have not addressed the effects of these constructs (Campion, 1988; Campion & McClelland, 1991; Campion & Thayer, 1985). Previous research using the MJDQ has used it to operationalize job characteristics as independent variables, whose effects on a variety of outcomes, such as job satisfaction (Campion & Thayer, 1985) and compensation (Campion & Berger, 1990), were then investigated. The only previous research which used the MJDQ to measure outcomes were two instrument validation studies (Campion, Kosiak & Langford, 1988; Campion &
Figure 6. Effects of Computerization and Moderator Variables on The Perceptual/Motor Job Design Model.
Stevens, 1989). Thus, the failure of this research to discover effects of professional and functional status in seven out of nine hypothesized cases is not at variance with other research findings.

In the next section this chapter of data analysis is briefly summarized.

**Summary of Chapter Four**

The case study describes a library which deliberately sought to avoid changing jobs during computerization. This was done to avoid increases in personnel cost as the library contended with staff and budget reductions.

The mail survey shows that library workers' jobs are affected in a variety of ways by computerization with ILS. None of these effects are large, but they are not so small that they can be safely disregarded. The proportion of time a worker spends working with the ILS has effects on both mechanistic and motivational job characteristics. Other variables which measure the extent to which an ILS is present in the workplace have more focused effects. Professional and functional status have only limited moderating effects.

Case study and mail survey have been conceptualized as two components of a multimethod research design. The mixed findings relating to a conceptual linkage between these two components based on MJDQ data undercuts the multimethod design to some extent. This has the effect of emphasizing
the separate contributions that the case study and the mail survey can make as separate and whole pieces of research. In the following chapter the findings, conclusions and recommendations of the research are presented.
Chapter Five

In this chapter the findings, conclusions and recommendations from the research are reported. The research design allows three different perspectives to be taken regarding the question of how computerization affects jobs in public libraries. The case study and the mail survey employ different methodologies and different data bases; each can stand alone as a separate piece of research. As the two research designs complement one another they may be combined in a third multimethod perspective. In this chapter the research findings and conclusions are presented in three sections, one for each methodological perspective. In the following section the theoretical context of the research is reviewed.

Theoretical Context of the Research

In their discussion of the causal structure of theory on the organizational effects of computerization, Markus and Robey (1988) distinguish three separate structural dimensions. One of these dimensions, causal agency, relates to the beliefs held by theorists about the nature of causality. The second structural dimension, logical structure, involves the way in which theorists understand the relationship between cause and effect. The third
structural dimension is the level of analysis, which identifies the entities which constitute the theoretical focus, such as individuals, groups, organizations, or societies.

"Causal agency refers to the analyst’s beliefs about the identity of the causal agent, the nature of causal action and the direction of causal influence among the elements in a theory" (Markus & Robey, 1988, p. 585). Markus and Robey identify three different theoretical perspectives about causal agency. The first of these perspectives is the technological imperative, which sees technology as an exogenous force imposing its requirements within the organizational setting.

The second perspective on causal agency identified by Markus and Robey (1988) is the organizational imperative, which views the choices of organization members as determining the organizational effects of technology. The third perspective is the emergent perspective, in which outcomes result from the "dynamic interaction of external circumstances and internal motives or interests" (p. 585).

Many theorists adopt one of these perspectives on causal agency a priori, with the result that research never tests which perspective best describes reality. In the case study research reported here this omission was avoided by making identification of an appropriate causal perspective an explicit research question.

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Markus and Robey (1988) use the contrast between variance and process theories to explicate the dimension of logical structure. Variance theories see an invariant relationship between cause and effect, one in which a cause is always succeeded by an effect, and in which differences in quantities of causal variables always result in corresponding differences in quantities of effect variables. In contrast, process theories only assert that causes may result in effects, implying that the presence of a causal factor will not inevitably result in an effect.

Different logical structures can be mapped to different research methods. In the present research the case study design can be understood as a method which adopts a process approach to logical structure, while the mail survey can be seen as following a variance approach.

The third element of causal structure discussed by Markus and Robey (1988) is level of analysis. This element involves the issue of whether the subjects of the research are individuals, groups, or organizations, and requires careful specification in order to make sure that constructs and measures are appropriate to the phenomena of interest. Although the tendency is for most research to be conducted at either the macro or micro level, Markus and Robey suggest that the complex nature of computer effects in organizations is evidence that more mixed level research is needed.
The case study research reported here began by focusing on the job as the level of analysis. In the course of the investigation, evidence emerged that computerization had produced effects at the organizational level of analysis. In order to integrate this finding into the research, it was necessary to relate it back to the job level of analysis which was the primary research focus. The mail survey research focuses on the individual level of analysis, but includes variables from other levels such as group, organization, and profession.

In the following section the findings and conclusions of the case study research are presented.

The Case Study

One way of learning how job characteristics in libraries are affected by computerization is to examine how a library computerizes. Conducting such an examination using conventional research designs such as before and after studies, or participant observation during computerization, is impractical, since most libraries have already computerized. One way to address the research design problem is to use a research method which relies on memory, both human and institutional, and to carry out the research in a site where computerization has occurred recently (Yin, 1994).

In this research a case study method was used to investigate the Norfolk, Virginia, Public Library (NPL).
NPL was in the final stages of implementing an integrated library system (ILS) when this research was carried out in 1995. This allowed the use of interviews and questionnaires to capture the memories of individuals, as well as the use of documents and archives to retrieve institutional memories.

The case study sought to answer three questions:
(a) Has computerization with an ILS changed job characteristics at NPL?;
(b) If so, what has been the nature of this change?; and
(c) Was NPL's implementation of ILS consistent with one of the three causal perspectives identified by Markus and Robey (1988)? In the following section the findings of the case study are examined.

**Findings of the case study.**

Jobs at NPL changed in many ways during computerization, and many of these changes resulted from computerization. Numerous interview respondents told how work methods had changed greatly when the computer system was implemented. These changes were found throughout the library system, in all departments and branches.

Job characteristics as measured by the multimethod job design questionnaire (MJDQ) did not change at NPL between 1990 and 1995. This disappointing finding does not contradict the overall finding that computerization with an ILS changed jobs at NPL.
Interviews identified a variety of changes in jobs which were linked with computerization:

(a) as time passed there were progressively fewer jobs;
(b) staff resources were withdrawn from branch libraries to the central library;
(c) non-professional staff were assigned tasks which had formerly been considered professional, and the distinction between professional and non-professional work was blurred;
(d) the computer system absorbed routine work which had been required by the previous manual work systems;
(e) workers were able to spend larger proportions of their time developing service programs and working with the public;
(f) the staffing demands of ILS implementation increased staff workloads during the implementation period;
(g) the diversion of four new automation positions away from other work units increased the workload borne by individual workers in those units;
(h) tasks were made easier by the ILS, and worker productivity increased;
(i) the ILS provided better information for decision making and for user services;
(j) the use of computer equipment as a universal tool changed both the physical environment of the workplace and the physical demands of the work itself; and
(k) some workers experienced eyestrain, repetitive motion injury, and stress.

Time series analysis of budget and staffing trends found that the cost of maintaining the computer system contributed to the loss of staff at NPL. In addition, four jobs were created to operate the computer system, further reducing the number of jobs assigned to other activities. In order to avoid increases in personnel cost NPL administration actively avoided job reclassification actions. Although NPL staff stated in interviews that computerization and downsizing were separate phenomena, this research finds that computerization and downsizing were closely linked.

Pattern matching logic identifies an emergent causal agency perspective as best fitting the case study data. Interviewees identified a wide variety of sources of responsibility for job design. The workers themselves, their supervisors, the library administration, and the city human resources department were all named. Some interviewees suggested that the computer system became the source of responsibility. In fact the library administration avoided paying attention to job design, seeking to avoid job reclassifications as much as possible, and allowing events to determine the outcome. Day to day responsibility for job design fell to unit heads and branch managers, who proceeded to fit the new computerized
procedures into existing patterns of work as closely as possible. As unanticipated consequences of computerization emerged, reactive adjustments were made throughout NPL. This is the pattern of the emergent perspective.

In the following section the conclusions drawn from the case study are reviewed.

Conclusions from the case study.

Despite managerial attempts to avoid changes in jobs at NPL by avoiding job reclassification actions, jobs in the library system did change as a result of computerization. However, the attempt at avoiding change had consequences, as job design decisions were largely left to supervisors and incumbents. These individuals had no mandate to change jobs, so they made only such adjustments in existing jobs which they thought necessary for successful use of the computer system. This dynamic accounts for the statements made by several interviewees, saying that jobs had not changed while work methods had, and that the computer determined what changes were necessary.

Computerization and downsizing were interrelated at NPL. Each was both cause and effect, a phenomenon that is consistent with an emergent perspective on causality.

Computerization led to downsizing by making downsizing workable and by consuming resources that could otherwise have funded staff positions. Downsizing led to
computerization because computerization was a means for achieving downsizing.

The efficiencies obtained through computerizing made the loss of jobs tolerable as measured by the continued ability of NPL to provide services to the public. One interview respondent said of the relation between ILS and staff workload, "Didn't make it good, made it possible" (Interview with a branch head).

Job design is one of many approaches to organizational development and planned change recommended in the organizational behavior literature (Cummings & Huse, 1989). Although computerization did result in changes in jobs at NPL, these were not linked with the adoption of a planned change perspective. Instead, NPL focused on the technical aspects of computerization and allowed new job characteristics to emerge. In doing this NPL missed a valuable opportunity to use job design for organizational development purposes.

One of the findings of this case study was that an emergent causal perspective best fit the pattern of events at NPL. This finding provides additional support for the other findings and conclusions of the case study research by providing a plausible explanatory framework. The main value of this finding, however, is its potential for supporting future theoretical efforts. Causal agency is an important consideration in theory building (Markus & Robey, 1988), and
any conceptualizing based on this case study must incorporate the implications of the emergent perspective.

This concludes the discussion of the case study research. In the following section the findings and conclusions of the mail survey are presented.

The Mail Survey

An alternative way of learning how jobs in libraries are affected by computerization is through a survey of library workers. In this research a mail survey of public library workers belonging to the Virginia Library Association was carried out. A four wave mailing procedure was used with a random sample of 277 potential respondents. Two hundred and twenty one usable responses were received, a usable response rate of 80 percent.

Job design and job characteristics are of interest because they are a primary locus for the interaction of technological and social factors within organizations (Davis & Wacker, 1987; Rousseau, 1977; Slocum & Sims, 1980; Trist et al., 1963). Job design theory is operationalized in this research using an instrument, the MJDQ, developed in the context of multidisciplinary job characteristics theory (Campion, 1988; Campion & Thayer, 1985, 1987).

The survey instrument included three job characteristics subscales from the MJDQ. These three subscales measure the motivational, mechanistic, and perceptual/motor characteristics of jobs. Motivational jobs
are more demanding and error prone, but elicit higher levels of job satisfaction and performance than do other job models. Mechanistic jobs are undemanding and routine, and are designed to achieve efficient patterns of work. Perceptual/motor job characteristics emphasize low mental demand and reliability of performance. In addition the survey instrument included measures of library computerization and of respondent characteristics.

Library computerization was measured in two ways. One of these was a measure of which of eight potential ILS modules (Johnson, 1991) were present in the respondent’s workplace, the other measured the proportion of work time the respondent spent working with the ILS.

Other measures on the survey instrument gathered data on professional status, functional status, library size, supervisory status, seniority, age, and gender. Professional and functional status are predicted by the literature to affect library jobs (Chase & Tansik, 1983; Lynch, 1974; Perrow, 1967; Reeves, 1980). Organizational size has been found to have significant effects on how technology affects organizations (Gerwin, 1981; Miller et al., 1991). Multidisciplinary job characteristics theory predicts that job level will affect motivational job characteristics (Campion & Thayer, 1985), and supervisory status was used in this research to operationalize job level. Seniority, age, and gender have also been found to
have some effect in previous job design and computer effects research (Campion & Thayer, 1985; Kraut, Dumais & Koch, 1989).

Because the mail survey was carried out in four waves there was some potential that the method itself could bias the data. In order to control for this possibility a method variable, mail survey cohort, was created and included in the analyses. Data for this variable were measured by recording the date of receipt for each response.

One of the two measures of library computerization gathered data on which of eight potential ILS modules were present in a respondent’s workplace. The data from this measure raised the question of how it should be analyzed. If it were summed, then respondent scores would be ambiguous, but if the eight ILS modules were treated as separate variables then the resulting analyses would be cumbersome. A solution for this issue was found through principal components analysis, which showed that the data for this measure could be divided into two components. These components were interpreted as "public service computing" and "backroom computing".

The three main research hypotheses proposed that computerization with an ILS would affect each of three different types of job characteristics described by multidisciplinary job characteristics theory (Campion, 1988; Campion & Thayer, 1985, 1987). An additional nine research
hypotheses proposed that professional and functional status would moderate the effect of ILS on each of the three types of jobs. The hypotheses were tested with hierarchical multiple regression analysis.

Previous research with the MJDQ had revealed a characteristic pattern of correlations between the three job design types. Therefore, intrasubscale correlations were computed for the mail survey data and compared with the characteristic pattern. The purpose of this comparison was to determine whether or not the library jobs measured by the survey were comparable with the jobs measured by previous multidisciplinary job characteristics research.

In the following section the findings of the mail survey are described.

Findings of the mail survey.

The principal components analysis found that eight ILS modules can be readily expressed as two principal components. The public service computing component consists of the three ILS modules for the public catalog, circulation, and cataloging. The backroom computing component consists of the four ILS modules for accounting, acquisitions, collection development, and serials control. Full public service computing existed in the workplaces of 80 percent of survey respondents, and was generally more prevalent than was backroom computing. The eighth ILS module, bindery, did not load on either of these components.
This is because only three percent of respondents indicated its presence in their workplaces.

The effects of ILS on job characteristics varied between the three job models, and few moderator variable effects were found. Motivational job characteristics diminish as the proportion of time spent working with the ILS increases, while working in a library with backroom computing increases these characteristics. Functional status moderated the effect of ILS on motivational job characteristics. An increasing proportion of time spent working directly with the public is associated with lower motivational job characteristics.

Mechanistic job characteristics tend to be greater as workers spend a greater proportion of their time working with the ILS. None of the predicted moderator variables affect this job model, but job level does have an effect. Mechanistic job characteristics tend to be reduced for workers who supervise others.

Perceptual/motor job characteristics tended to be reduced in libraries with public service computing. Professional status tended to enhance this effect.

The sizes of all these effects fell in the small to medium range, with r values falling between .13 and .28. Cohen (1988) defines a small effect size as r = .10, and a medium effect size as r = .30.
In addition to the unanticipated finding that job level affects mechanistic job characteristics, the method variable which measured mail survey response cohort produced statistically significant results with the perceptual/motor subscale. This is evidence that a method artifact resulted from the mail survey and was statistically controlled through the use of this variable.

In previous research using the MJDQ a characteristic pattern of intrasubscale correlations has been found. This has resulted in the motivational subscale being inversely correlated with the mechanistic and perceptual/motor subscales, while these latter two subscales are positively correlated. When these correlations were computed from the mail survey data this pattern was not found. Instead the sole statistically significant correlation, between the motivational and perceptual/motor subscales, was in the opposite direction to that expected.

Conclusions from the mail survey.

Computerization with an ILS has small to medium effects on job characteristics in public libraries. Three different measures of job characteristics were affected by different measures of computerization. Professional and functional status had limited effects, as did supervisory status.

Time spent working with the ILS had effects on two different types of jobs, motivational and mechanistic. These effects were in opposite directions, which is
consistent with the prediction of multidisciplinary job characteristics theory (Campion & Thayer, 1987). As workers spend a larger proportion of their time working with an ILS their jobs become more mechanistic, and, to a lesser degree, less motivating. This is the most significant finding of the mail survey research for practice, as the proportion of time a worker spends with the ILS can be controlled.

Public service computing was associated with lower levels of perceptual/motor job characteristics. This finding of increased job complexity as an outcome of computerization confirms the predictions from the literature (Johnson, 1991).

Backroom computing was associated with very small increases in motivational job characteristics. The size of this effect was the smallest found in this research, indicating that the finding has little practical significance.

Professional status was associated with lower levels of perceptual/motor job characteristics, indicating that the jobs of professional library workers are more cognitively demanding than the jobs of other library workers. This is consistent with the predictions of the literature (Reeves, 1980; Johnson, 1991). This finding indicates that professional and non-professional library jobs differ primarily on a cognitive dimension, as the other two job models were unaffected by this variable.
Functional status was operationalized for this research as the proportion of time a worker spent with the public. Spending a larger proportion of work time with the public is associated with lower levels of motivational job characteristics. Chase and Tansik (1983) point out that customer service work involves loss of control by the worker to the customer, and such loss of control would tend to counter such features of motivational job design as autonomy and task identity. The size of this effect is small, as is its practical significance.

The finding that computerization with an ILS can be measured on two orthogonal components is not predicted by the literature. This finding has the potential for refining the way that library computerization is measured in future research.

The contrast between the intrasubscale correlational pattern of the mail survey data and the pattern which characterizes previous research using the MJDQ suggests that public library jobs are different from the jobs examined previously. Previous research examined production jobs in the forest products industry (Campion & Thayer, 1985), a variety of jobs in an electronics manufacturing company (Campion, 1988), office worker's jobs in a financial services company (Campion & McClelland, 1991), and also university students in two validation studies (Campion, Kosiak & Langford, 1988; Campion & Stevens, 1989). None of
these research settings are in public agencies, nor do they have significant public service components.

Campion and Thayer (1987) develop the concept of a mental demands continuum where mentally demanding jobs fall at one end of the continuum and mentally undemanding jobs at the other. The motivational job model falls at the mentally demanding end of this continuum, while the mechanistic and perceptual/motor models fall at the undemanding end. The implication of the positive correlation between motivational and perceptual/motor subscales in the survey data is that more motivating jobs are less mentally demanding, and that less motivating jobs are more mentally demanding. This finding does not fit well with multidisciplinary job characteristics theory, and indicates that the mental demand characteristics of public library jobs are somewhat atypical of jobs in general.

This concludes the examination of the mail survey conclusions. In the next section the findings and conclusions of the multimethod perspective on this research are examined.

Multimethod Research Perspective

Throughout this research the multimethod research design has been invoked as a broad framework which subsumes the case study and the mail survey. The finding of a significant difference between NPL staff and mail survey respondents on the perceptual/motor subscale of the MJDQ
undermined the research plan for using questionnaire data to bring the case and the survey together. Because of this the findings and conclusions from the multimethod perspective are limited.

In their discussion of multimethod research design, Brewer and Hunter (1989) state that multimethod research can differ on two dimensions, those of research method and of operationalization of the hypotheses. When both dimensions are varied in a single research design, the resulting multimethod design will control for bias deriving from either source. Thus, the rival hypotheses of method bias or measurement error can be excluded in a successful multimethod research design. In the following section the findings and conclusions which are supported by the multimethod perspective are described.

Findings and conclusions from the multimethod perspective.

The findings of the case study and the mail survey converge to support a multimethod finding that computerization with an ILS does affect library jobs characteristics. Each of these two different methods applied a different measurement instrument to capture data on job characteristics. In the mail survey the instrument was the MJDQ, and in the case study it was the interview procedure. Therefore, the finding of an effect of computerization on library jobs is robust as regards the
threats to validity posed by measurement error and method bias.

The multimethod research design is less powerful when it is applied to understanding the nature of the effect of computerization on library jobs. This is primarily because the single case study design lacks external validity (Yin, 1994). However, mail survey findings do have external validity, and can be integrated with findings from the case study. The evidence for similarity of job characteristics at NPL and in the mail survey sample, as measured on the motivational and mechanistic subscales of the MJDQ, provides empirical support for such an integration.

There are several points of convergence between the case study and the mail survey relating to specific findings about the nature of computerization effects. Both case and survey found that neither professional nor functional status made much difference. The case study found evidence that the traditional distinction between professional and non-professional work had become blurred at NPL, and the mail survey analysis found only a single significant effect of professional status, in the case of the perceptual/motor subscale data. This mail survey finding is consistent with data from the case study interviews in suggesting that professional jobs are more complex than non-professional jobs. A similar situation exists with functional status. Interviewees at NPL thought there was little difference
between functional units in how the ILS had affected jobs, and the mail survey analysis found only one significant effect of functional status, in the case of the motivational subscale.

Another point of convergence between case study and mail survey relates to the mechanistic subscale. The largest effect size from the mail survey analysis was found with this subscale. Mechanistic jobs tend to be simple and repetitive, as they are designed with efficiency as their main objective. The ability of NPL to successfully adapt operations to its constantly shrinking labor force, and the statements of interviewees that the ILS had made their jobs easier and more efficient are both convergent with the mail survey finding.

The use of convergent reasoning to develop specific findings is a strength of the multimethod approach. However, it is also possible to take a broader perspective, one which seeks to achieve a synthesis of the research as a whole.

The original research conception was planned so as to learn if library administrators need to adapt to changes in jobs resulting from computerization. This conception did not adopt the technological imperative perspective, but did conceive of the possibility that a belief in such a perspective among ILS implementors could produce equivalent results. If the case study were to find that ILS
implementors paid no attention to job design, then the results of the mail survey could be understood as generally applicable to all libraries which similarly ignored job design. Such an outcome could be described as a socially negotiated (Berger & Luckmann, 1966) agreement within libraries to adopt the technological imperative perspective. This would then imply that any changes in jobs resulting from computerization would be accepted by library administrators as inevitably requiring reactive adjustments. If these changes required higher compensation, then budget increases to pay for these would somehow have to be found.

The findings in the case study did not fit this prediction. Library administrators at NPL did not ignore the possibility that computerization of jobs could raise compensation levels; by avoiding job reclassification they sought to avoid this scenario. Further, NPL administration defined the ILS implementation task in such a way that job redesign was not a consideration. In doing this they followed the general example provided by the library profession. However, NPL administration only followed the professional exemplar when it suited them. Professional norms were sacrificed when doing so fit with the need to stay within the budget. So, in contrast to the expectation of the original research concept, ILS implementors at NPL did not ignore job design issues. Instead, they actively sought to avoid making changes that would increase costs.
If they had known of the findings of the mail survey portion of this research, they might have decided that the risk of computerization increasing compensation was inconsiderable. The mail survey findings suggest that any changes in job compensation resulting from computerization are likely to be minimal. The only computerization related factor which may tend to increase job compensation is the higher level of mental demand which results from increased complexity.

However, computerization affects jobs directly and indirectly. This research was planned to focus on direct effects, but the situation at NPL highlighted the indirect effects of decreasing budgets and staff downsizing. The pressure of simultaneously computerizing and downsizing at NPL produced a situation where little attention could be paid to planned change in job designs. So ultimately, despite the efforts of administrators to adopt a proactive stance by avoiding changes in jobs, the combination of computerization with reductions in budget and staff produced a situation where administration was forced into a reactive posture. However, the increased costs which pressured the budget and resulted in additional staff reduction came in this case from the expense of maintaining the computer system, rather than from increased compensation for redesigned jobs.

This concludes the discussion of the contribution of the multimethod perspective to this research. In the final
section of this chapter recommendations are made for practice and for research.

Recommendations

The results of this study suggest recommendations to practicing administrators and for future research. In the following section recommendations for administrative practice are made.

Recommendations for practice.

If computerization is used to support downsizing, as in the NPL case, attention should be paid to the scheduling of staff reductions. Staff cuts should not be made until the implementation project is well advanced, nor until the efficiency payoffs from computerization begin to be realized. In NPL's case this would have meant postponing major staff cuts from July 1991 until July 1993, when the circulation module was in use throughout the system and the public catalog was about to become generally available. Cutting staff prematurely risks service failure, and places a tremendous burden on those staff who remain.

Administrators may be sensitive to the possibility that changes in job characteristics will result in increased personnel costs. Previous research linking job design and compensation (Campion & Berger, 1990) indicates that higher compensation levels are associated with higher levels of motivational job characteristics, and with lower levels of mechanistic and perceptual/motor job characteristics.
Administrators concerned that job reclassification will put pressure on their personnel budget could select job designs which score low on motivational characteristics and high on mechanistic and perceptual/motor characteristics. Such jobs would be simple, routine, undemanding, and require little training, but would carry some risk of undesirable outcomes such as low motivation, absenteeism, and turnover (Campion & Thayer, 1987).

Variables which affect job characteristics can be classified as controllable or uncontrollable. Administrators can manipulate controllable variables to achieve desired results. Uncontrollable variables cannot be manipulated; instead they have to be factored into decisions as constraints. Most of the statistically significant predictor variables in the mail survey analyses are uncontrollable in nature.

ILS effects on motivational job characteristics are sufficiently small that they can be safely omitted from consideration by decision makers. The effects of ILS on mechanistic and perceptual/motor job characteristics are large enough that administrators should consider them in making job design decisions. In particular, it is clear that a job design which requires spending a large proportion of time working with the ILS tends to have mechanistic characteristics. This is a factor which is amenable to administrative control. If administrators do not want
mechanistic jobs, they have the option of finding ways for
workers to spend time away from the ILS.

Where uncontrollable factors such as the extent of
computerization are inconsistent with the job design values
of administrators, then efforts to counter the effects of
computerization will be necessary. For example, if an
administrator wants to design undemanding jobs according to
the perceptual/motor model, then actions must be taken to
compensate for the fact that public service computing tends
to diminish perceptual/motor job characteristics. Some ways
in which this could be done include the following
suggestions:
(a) work with ILS vendors to improve ease of use of the
system software and the supporting documentation;
(b) redesign the physical work setting;
(c) reduce memory requirements through use of procedure
manuals, action forms, mnemonic devices, and expert systems;
(d) make stress reduction an objective; and
(e) because professional status tends to reduce
perceptual/motor job characteristics further, pay additional
attention to making the jobs of these staff members less
demanding.

These recommendations have focused on perceptual/motor
job design because, of the three job design models, it was
most sensitive to uncontrollable factors. In the following
section recommendations for future research are suggested.
Recommendations for future research.

Several different paths for future research can be recommended. One topic that emerged from the case study is the effect of computerization on personnel budgets. There is little suggestion in the literature of library automation, or in the literature of computer effects, to suggest that computers will exercise an effect on jobs by reducing the funds available to pay for them. The contrary finding from this research suggests that further research is needed.

One direction such research could take would be to determine the prevalence of this effect of computerization. This could be done by examining archival data from a representative sample of organizations over time. The time period to be examined would include the point at which computerization occurred. One possibility would be to extend the pooled time series models which Bland and Nunn (1992) developed for explaining the effect of capital budget expenditures on operating budgets. This could be done by substituting staff for operating budgets as the dependent variable, and by adding an independent variable to represent the decision to computerize. This research would be at the macro level of analysis, the level of whole organizations.

Another research direction for investigating the effect of computerization on staffing levels, but one located at the micro level of analysis, would be to investigate the
question of managerial intent. It is possible to understand the replacement of workers with computers as a course of action deliberately selected by managers, or, alternatively, as a constraint which is reluctantly accepted by managers as a consequence of the decision to computerize. Further, it is possible for both of these decision approaches to exist within an organization. This research could be carried out using a multiple case study design (Yin, 1994).

Another emergent finding of this research was of two different components of computerization with an ILS, public service computing and backroom computing. Differences among organizations create problems for the development of measures of computerization. In this case the two components parallel the typical service organization structure of dividing into public service and supporting service units (Chase & Tansik, 1983). This suggests that this finding can be extended from libraries to other types of service organizations.

Research seeking to achieve such an extension of the contrast between public service and backroom computing to other organizations would require careful specification. The computer system features which would comprise such components in other types of service organizations would not be the same as those found in this research. Initially, exploratory research should investigate which types of service organizations rely heavily on computers and would
make good subjects for further research. This exploratory research would provide a basis for specifying the computer system features of importance in those types of organizations. Once this exploratory research is complete, survey research can be used to gather data on the degree of presence of the specified system features and other variables of interest. This data can then be subjected to principal components analysis to determine whether or not the distinction found here in public libraries can be extended to other types of service organizations.

Multidisciplinary job characteristics theory did not predict two findings of the present research. The first of these findings was the effect of job level on mechanistic job characteristics. The second was the different pattern of intrasubscale correlations, suggesting that library jobs somehow manage to include characteristics from both ends of the mental demands continuum. Both of these findings should be investigated further.

Previous multidisciplinary job characteristics theory research has operationalized job level in several ways. Campion and Thayer (1985) operationalized job level in terms of equal employment opportunity codes and pay. Campion (1988) operationalized job evaluation level as the points awarded by the job analysis system used by the organization where the research was carried out. The present research used the number of employees supervised to operationalize
job level. The difference between findings associated with these different operationalizations of job level is a threat to the construct validity of the mechanistic subscale of the MJDQ. An appropriate research strategy in this case would be a multitrait-multimethod analysis (Campbell & Fiske, 1959) which includes these different operationalizations of the job level variable.

The different pattern of intrasubscale correlation found in this research can be interpreted as indicating that public library jobs are different from the jobs investigated in previous research using the MJDQ. This finding should be confirmed using meta-analysis (Rosenthal, 1991). Meta-analytic procedures allow data from multiple independent research studies to be compared and combined, and thus can indicate whether or not the different intrasubscale correlational pattern found in this research differs substantially from previous research.

Should the present finding of a different intrasubscale correlational pattern be substantiated by meta-analysis, then this opens the door for several interesting questions. How can multidisciplinary job characteristics theory account for jobs which combine high and low levels of mental demand? What factors determine the difference between the type of jobs found in libraries and other types of jobs? Are there only two types of jobs, those found by previous MJDQ based research and those in public libraries, or are there
additional types? Investigation of these questions is not a matter for a single investigation, but rather for an entire research program.

Another possibility for future research is the replication of this research, in whole or in part, in other types of libraries, such as academic, school, or special libraries. This could reveal whether there are differences among library types regarding job characteristics, the effect of professional and functional status, or the existence of two separate components of ILS, public service computing and backroom computing.
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Appendix One
Case Study Protocol

This protocol provides information on research which focuses on computerization and jobs at the Norfolk, Virginia, Public Library. This information is for use by the researcher in implementing the research design, and also provides information useful to readers of the case study report. The protocol begins with a brief overview of the research, then goes on to review field procedures, and case study questions, then concludes by discussing how the research will be reported.

Overview

This case study is a component in a larger multimethod research design. The other component is a mail survey. The research is being carried as part of a Ph.D dissertation in the Urban Services Management program at Old Dominion University.

Research Questions

The research focuses on the question of whether computers have affected job characteristics in public libraries. A further question, if the "whether" question is answered in the affirmative, asks what is the nature of the
effect of computers on job characteristics in public libraries.

Variables

Job characteristics are conceptualized and measured following multidisciplinary job characteristics theory (e.g. Campion, 1988). This theory integrates four different models of job design from four different disciplines. The models and disciplines are:

(a) motivational jobs, deriving from organizational psychology;
(b) mechanistic jobs, taken from classical industrial engineering;
(c) biological jobs, based on work physiology; and
(d) perceptual/motor jobs, with roots in experimental psychology and human factors research.

Other contextual variables are likely to condition the potential of computers for affecting job characteristics. Reeves (1980) suggests that professional status of an individual is important, and Chase and Tansik (1983) suggest that functional status is as well. Functional status most clearly relates to the issue of whether or not a job involves direct interaction with the public.

The Research Site

Norfolk Public Library (NPL) has been selected as the site for this case study research because it has recently computerized. In fact, NPL is unique, because other similar
public libraries computerized several years earlier. Because memories of computerization at NPL are still fresh, use of interviews and questionnaires can be expected to gather valid information there.

Research Issues

Literature relating to computers and organizations suggests that the answer to questions about organizational effects of computers depend on the choices made by those who select and implement computer systems. These choices are expected to reflect the values of the responsible individuals. Therefore, a salient issue in this research is identification of who is responsible for determining job characteristics at NPL, and what values they bring to bear on this determination.

Three different methods will be used to gather data. NPL staff will be asked to respond to questionnaires, and to participate in interviews. In addition, relevant documents and archival materials will be sought and examined.

This concludes the overview section of the case study protocol. In the next section field procedures are reviewed.

Field Procedures

Access to the NPL must be granted by the Library's administration. When granted the researcher should obtain confirmation of the permission in writing. Once permission is granted, then data gathering activities can be scheduled.
as appropriate. The administration should be asked at this point to identify three or four key individuals as potential interview subjects. Field procedures for each of the data gathering methods will be described in the following sections, beginning with administration of the questionnaires.

**Questionnaires**

Administration of the questionnaires must be scheduled in cooperation with the NPL administration. The questionnaires should be administered under as controlled circumstances as possible. The ideal case would be at a specially scheduled meeting, with all instruments being retrieved immediately. If this scenario cannot be arranged, then the questionnaires should be administered in the course of a regularly scheduled staff meeting. Only if this is not possible should a less controlled approach be used; the help of the NPL administration should be sought to arrange as controlled a delivery of the questionnaire as the circumstances permit.

It is important that questionnaires only be administered to individuals who were present during the automation project. This can be accomplished by obtaining information from NPL administration identifying the names of NPL staff who meet this criterion. When the questionnaires are distributed they should each have a removable label attached bearing the name of a qualified respondent. The
directions to the respondents should instruct them to remove
the label before they return the completed questionnaire.

Before the questionnaires are administered, the
researcher should address the group of potential
respondents. This address should include a statement of the
scope of the research, the fact that the questionnaires are
about objective job characteristics and do not ask any
personal questions, and that participation is voluntary.
The researcher should invite questions before distributing
the questionnaires. Once the questionnaires are
distributed, the researcher should remain present and gather
them as they are completed.

This completes the description of the field procedures
relating to questionnaire administration. In the next
section the interview procedure is described.

Interviews

Interview respondents will be selected using the
snowball sampling technique. This technique begins with a
few individuals of known importance to the computerization
project; the names of these individuals will be obtained
from NPL administration in the course of obtaining access to
the research site. As each of these individuals is
interviewed, they are requested to name three individuals
who would be valuable interview subjects. The named
individuals are then interviewed. This is an open ended
technique, and should come to closure when all individuals
considered as valuable interview subjects by NPL staff members have been interviewed. This will become clear when no new names are suggested as potential future interview subjects.

Because of the open ended nature of the snowball process, the researcher must remain alert to the possibility that closure may not occur. If the process does not approach closure after 15 interviews, then the researcher should examine the pattern of interviewee recommendations to determine if the snowball technique is performing as planned. This examination should be documented for later inclusion in the case study report. If the examination indicates a failure of the snowball technique, then closure of the interview process should be based on a determination of whether or not additional interviews are anticipated to be productive of new information.

Interviews are designed to follow the funnel technique (Bouchard, 1976). General questions are posed first, with more specific ones later. If the answer to a specific question is inconsistent with an answer to a previous general question, then the interviewer should ask the respondent to clarify their answer. In general, the interviewer should be non-directive, and let the respondents interpret and respond to the questions as they see fit.

The researcher should bring the following supplies to each interview: tape recorder, two blank tapes, a note pad,
two pens, the text of the introductory statement and questions, and two copies of the informed consent form on a clip board. A copy of the researcher’s business card should be placed on the clip board on top of the informed consent forms.

Before beginning an interview, the interviewer must first read an introductory statement, which includes requesting permission for use of a tape recorder, and then present the clip board, business card, and two copies of the informed consent form to the interviewee. The interviewer should invite the respondent to take the business card, telling the respondent that this is in case they wish to call him later with any questions. The respondent must be asked if they have any questions, and then must read and sign the informed consent form. Once the form is signed, the researcher must sign both copies, return one copy to the respondent, and keep the other signed copy, which will be included in the case study database. The texts of the introductory statement and the informed consent form is included in the Case Study Questions section of this protocol.

Once informed consent has been obtained, the interviewer should make sure that all the materials (tape recorder, tapes, pens, notepad, and text of questions) are at hand. If permission to tape has been given, then a tape should be placed in the tape recorder and recording started.
If permission has been denied, the tape recorder and tapes should be put away before any questions are asked. The questions should be asked clearly, and the respondent given plenty of time to answer each one.

Responses should be recorded in writing on the note pad. This gives some assurance that data will be gathered if the tape recorder fails. If permission to tape has been denied then written notes will be the sole data. When the interview has concluded the researcher should thank the respondent before packing up the materials.

On returning from the interview, the researcher should make a file folder labeled with the respondent’s name and the date of the interview. The written notes and informed consent form are placed in this folder. If tape recording occurred, then the tapes should also be labeled with the respondent’s name and the data of the interview. The write protect tab should be removed from the recorded tape to prevent accidental overwriting.

This completes the description of the field procedures relating to interviews. In the next section procedures relating to obtaining documents and archival information are described.

Documents and Archival Information

The primary method for locating documents is to inquire about them during interviews. The researcher must then use judgment in deciding whether documents identified by
Interviewees are of real value to the research. Any documents which are thought to be of value should be photocopied. If photocopying is not possible then written notes have to provide a substitute. The NPL should be reimbursed for the cost of making any photocopies. Potentially useful documents include plans, job descriptions, working papers, reports, and newsletters.

Other sources exist for archival information. In particular, for Norfolk city budget documents, it may be necessary to visit the city Budget Office. NPL has a vertical file collection of information such as newspaper clippings, reports, newsletters, and other miscellaneous materials on a variety of subjects, including NPL itself. The vertical file contents relevant to NPL should be reviewed. Another source is NPL administration, who should be asked to provide any documents which can provide information about the computerization project.

This completes the description of field procedures. In the next section the case study questions are reviewed.

**Case Study Questions**

This section of the protocol reviews the content of the questions used in the research. This includes the directions and items from the questionnaire instrument, the interview procedure, which includes both introductory remarks and questions, the text of the informed consent form used with interview respondents, and the list of codes used
in analyzing the interview content. The questionnaire directions are examined first.

Questionnaire Directions

The questionnaire directions to respondents are in two forms. One set requests the respondent to consider their job in 1990, and to answer the questions based on that recollection. The other set of directions requests the respondent to answer the questions based on how their job is at present. The directions which ask that responses be based on 1990 experience are as follows.

**Job as it was in 1990 questionnaire directions.**

This survey is part of a research project into the effect of computers on jobs in public libraries. Please help by answering the following 38 questions about the nature of your job. Answering will take about 10 minutes. No personal questions are asked. Because this survey is being given to a small group of people every response is very important; if you can help, please do.

Your answers are completely confidential. Once the completed questionnaires have all been received and logged, all information relating to personal identities will be permanently destroyed.

INSTRUCTIONS: When answering the questions, think about your job as it was in 1990, before your library implemented the integrated library computer system. To help you
remember what was happening in 1990, recall some of the things that happened then:

In world news, the United States invaded Panama in December 1989 and overthrew Manuel Noriega; in August 1990 Iraq invaded Kuwait; and in October 1990 Germany was reunified.

Bestselling books included Tom Clancy’s Clear and present danger, Robert Fulghum’s All I really needed to know I learned in kindergarten, Amy Tan’s The Joy Luck Club, and Charles Givens’ Wealth without risk.

Dances with wolves won best picture at the Oscars, and L.A. law was best show at the Emmys.

In sports the Detroit Pistons won the NBA Championship, the San Francisco 49ers won their fourth Super Bowl, and the Cincinnati Reds won the World Series.

Please indicate the extent to which you agree that each statement is descriptive of your job as it was in 1990 by circling your answer on the left. If you don’t know, or if it is not applicable, leave the question blank.

[MJDQ content is placed here.]

Thank you for your help.

The directions for answering the questionnaire based on the job as it is as present are as follows.

Job as it is today questionnaire directions.

This survey is part of a research project into the effect of computers on jobs in public libraries. Please
help by answering the following 38 questions about the nature of your job. Answering will take about 10 minutes. No personal questions are asked. Because this survey is being given to a small group of people every response is very important; if you can help, please do.

Your answers are completely confidential. Once the completed questionnaires have all been received and logged, all information relating to personal identities will be permanently destroyed.

INSTRUCTIONS: When answering the questions, think about your job as it is now. Please indicate the extent to which you agree that each statement is descriptive of your job by circling your answer on the left. If you don’t know, or if it is not applicable, leave the question blank.

[MJDQ content is placed here.]

Thank you for your help.

This is the end of the questionnaire directions. The content of instrument itself is given next.

Instrument Content

Motivational subscale items.

1. Autonomy: The job allows freedom, independence, or discretion in work scheduling, sequence, methods, procedures, quality control, or other decision making.

2. Intrinsic job feedback: The work activities themselves provide direct and clear information as to the
effectiveness (e.g., quality and quantity) your job performance.

3. Extrinsic job feedback: Other people in the organization, such as managers and co-workers, provide information as to the effectiveness (e.g., quality and quantity) of your job performance.

4. Social interaction: The job provides for positive social interaction such as team work or co-worker assistance.

5. Task/goal clarity: The job duties, requirements, and goals are clear and specific.

6. Task variety: The job has a variety of duties, tasks, and activities.

7. Task identity: The job requires completion of a whole and identifiable piece of work. It gives you a chance to do an entire piece of work from beginning to end.

8. Ability/skill level requirements: The job requires a high level of knowledge, skills, and abilities.

9. Ability/skill variety: The job requires a variety of knowledge, skills, and abilities.

10. Task significance: The job is significant and important compared with other jobs in the organization.


12. Promotion: There are opportunities for advancement to higher level jobs.
13. Achievement: The job provides for feelings of achievement and task accomplishment.
14. Participation: The job allows participation in work-related decision making.
15. Communication: The job has access to relevant communication channels and information flows.
16. Pay adequacy: The pay on this job is adequate compared with the job requirements and with the pay in similar jobs.
17. Recognition: The job provides acknowledgement and recognition from others.
18. Job security: People on this job have high job security.

Mechanistic subscale items.

20. Job specialization: The job is highly specialized in terms of purpose, tasks, or activities.
21. Specialization of tools and procedures: The tools, procedures, materials, etc., used on this job are highly specialized in terms of purpose.
22. Task simplification: The tasks are simple and uncomplicated.
23. Single activities: The job requires you to do only one task or activity at a time.
24. Skill simplification: The job requires relatively little skill and training time.
25. Repetition: The job requires performing the same activity(s) repeatedly.
26. Spare time: There is very little spare time between activities on this job.
27. Automation: Many of the activities of this job are automated or assisted by automation.

Perceptual/motor subscale items.
29. Lighting: The lighting in the workplace is adequate and free from glare.
30. Displays: The displays, gauges, meters, and computerized equipment on this job are easy to read and understand.
31. Programs: The programs in the computerized equipment on this job are easy to learn and use.
32. Other equipment: The other equipment (all types) used on this job is easy to learn and use.
33. Printed job materials: The printed materials used on this job are easy to read and interpret.
34. Work place layout: The work place is laid out such that you can see and hear well to perform the job.
35. Information input requirements: The amount of information you must attend to in order to perform this job is fairly minimal.
36. Information output requirements: The amount of information you must output on this job, in terms of both action and communication, is fairly minimal.
37. Information processing requirements: The amount of information you must process, in terms of thinking and problem solving, is fairly minimal.

38. Memory requirements: The amount of information you must remember on this job is fairly minimal.

39. Stress: There is relatively little stress on this job.

40. Boredom: The chances of boredom on this job are fairly small.

This concludes the presentation of the questionnaire portion of the case study questions. The case study questions relating to the interviews is presented next.

Interview Procedure

In this section of the protocol the contents of the document which guides the researcher during the interview are given, followed by the content of the informed consent form, and the list of codes used to analyze the interview data. The researcher’s interview guide includes a statement which must be read to the respondent as well as the questions to be asked.

Interview guide contents.

Introductory statement: I'm interested in the effect of an integrated library computer system on jobs in libraries. This is for my doctoral dissertation at Old Dominion University. Your Library’s administration has authorized my conducting this research here.
I'd like to spend some time listening to your opinions. Everything you say to me today is strictly confidential. If I use information you give me in my dissertation I won't identify you by name. Also, I won't reveal what you say to anyone here at the Library or with the City. Do you have any questions?

[At this point the informed consent form is presented to the respondent.]

With your permission, I'd like to record your answers on tape. May I do this?

As we proceed, if you think of any relevant documents, such as plans, job descriptions, or training procedures, please mention them; they may provide me with additional valuable information.

Warm Up Question: Please take a few minutes to tell me about yourself, your job and responsibilities here at the Library?

Main Question: How did you approach redesigning jobs in your library during computerization?

I'd like to go on now to ask you some specific questions.

1. Who was responsible for how jobs are designed?

2. Was any particular theory used in deciding how jobs should be changed?

Instruction to interviewer: If the answer to the preceding question does indicate some explicit theoretical
basis was used, proceed to question 3a and then to question 4; otherwise, proceed to question 3b.

3a. Where did you learn of this approach to designing jobs?

3b. Even though you haven't identified any particular theory as determining how you designed jobs, let me ask you where your ideas of how jobs should be designed did come from?

4. What kind of job resulted from your plans for implementing the ILS?

5. How did your job change? What changes in other people's jobs did you observe? Were these different from the changes that were expected?

6. Did ILS affect professional or support jobs differently? If they did, how? Was there any difference here between public and technical service staff?

7. Did ILS affect public and technical service jobs differently? If they did, how? Was there any difference here between professional and support staff?

Closing Remarks: Before we finish, I want to ask you to name three other people at Norfolk Public who were here when the ILS was implemented, and who might be able to help me.

Is there anything else you can tell me which might be useful for me to know?

Thank you for your help.
This concludes the content of the researcher's interview guide. The content of the informed consent form, which was approved by the Human Factors IRB of the Old Dominion University College of Business and Public Administration, is given next.

Informed consent form.

INFORMED CONSENT FORM

A research project which seeks to understand the effects of an integrated library computer system on the characteristics of jobs is being carried out at the Norfolk Public Library. The researcher is Richard J. Harris, a Ph.D student at Old Dominion University (phone: 446-5852). I understand that if I have any questions about this research I may ask the researcher about them at any time.

As a subject in this research I will be interviewed and asked to respond to questions about my personal experiences with the integrated library computer system at Norfolk Public Library. My responses will be recorded as handwritten notes, and, if I give my permission, by tape recording. I will also be asked to identify other potential interview subjects, and to identify documentary sources of information relevant to the research.

My involvement in this research is entirely voluntary, and I have the right to not respond to this request, and to withdraw from participation at any time. Any risks to me as
a subject are minimal, and I accept full responsibility for any adverse consequences of my participation.

A copy of this form has been provided to me by the researcher.

_________________________________________  ___________
Subject’s signature  Date

_________________________________________  ___________
Investigator’s signature  Date

This concludes the content of the informed consent form. The content of the list of codes used for analyzing the interview data is given next.

List of codes.

Theory of jobs ........................................ HOW
Theory of jobs source ................................. SOU
Responsibility for job design .......................... WHO
Planned job characteristics ............................ PLAN
Change observed ....................................... CHAN
Job characteristics - mechanistic ...................... MECH
Job characteristics - motivational ...................... MOTIV
Job characteristics - ergonomic ....................... ERGO
Status - professional ................................ PROF
Status - functional .................................. FUNC

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This concludes the case study questions portion of this protocol. In the next section the case study report is discussed.

The Case Study Report

The case study report will be integrated into a larger research presentation; the dissertation. Because the case study is a component of a multimethod research design, case study content will be divided among the appropriate chapters of the dissertation. No introduction or literature review will be written specifically for the case study; the first two chapters of the dissertation will serve this purpose. Specific case study material will be integrated into the final three chapters of the dissertation. A partial outline of these three final chapters, showing how this integration is planned is presented next.

Case Study Report Outline

Chapter 3: Methodology

Multimethod Research Design

Case Study Research Component

Case Study Design

Case Study Methods

Questionnaires.

Interviews.

Archival analysis.

Case Study Data

Mail Survey Research Component, etc.
Chapter 4: Analysis

Case Study Analysis

Introduction

The Implementation

How NPL Managed Jobs in the Context of Computerization

Questionnaire Data Analysis

  Job characteristics before and after computerization.

  NPL jobs compared with Virginia jobs.

Mail Survey Analysis, etc.

Chapter 5: Results

Case Study Results

Mail Survey Results

Multimethod Research Design Results

  This concludes the outline of the case study report.

In writing the report the researcher should have preliminary drafts reviewed for accuracy.

Case Study Report Draft Review

  The use of key informants to review preliminary drafts of case study reports is recommended by Yin (1994), who suggests that this supports construct validity. One aspect of such a review is that the researcher’s account is checked for accuracy, while another is that the informants may challenge or supplement interpretations of data.

  Information relating to such challenges or supplements should be included in the report. Informants should be
chosen carefully. They should be discreet, knowledgeable, able to be objective, and willing. Administrators who might revoke access to the research site if they were displeased with the contents of the draft report should not be selected.

This concludes the final section of the case study protocol, which discussed the case study report.
Appendix Two

This appendix includes the texts of the four survey mailings. One of these texts, the second, was transmitted in postcard format, while the other three texts were transmitted as cover letters accompanying copies of the instrument.

First Mailing Cover Letter

609 Amelia Avenue
Portsmouth, Virginia 23707
October 17, 1995

[Name and Address of Subject]

The use of computers in libraries has resulted in significant changes in library work. You can help improve our understanding of these changes by responding to the enclosed questionnaire.

You are one of a small number of people being asked how computers have affected your job. It is important that your questionnaire be completed and returned. If you do not work in a Virginia public library, please note this on the booklet and put it in the mail without answering the questions.

You can be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is so we can check your name off of the mailing list when your questionnaire is returned.

This research is a contribution toward my Ph.D. dissertation at Old Dominion University. I would be very happy to answer any questions you might have. Please write or call. The telephone number is (804) 446-5852.

Thank you for your assistance.

Sincerely,
Richard J. Harris

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Second Mailing Postcard

October 24, 1995

A week ago a questionnaire about the effects of computers on your public library job was mailed to you. Your name was randomly selected from the public library section of the Virginia Library Association mailing list. If you have already completed and returned it to me please accept my sincere thanks. If not, please do so today. Because it has been sent to only a small, but representative, sample of VLA members it is extremely important that your response be included in the study if the results are to accurately represent the experience of Virginia public librarians. If by some chance you did not receive the questionnaire, or it got misplaced, please call me right now at (804) 446-5852, and I will get another one in the mail to you right away.

Sincerely,
Richard J. Harris

Third Mailing Cover Letter

609 Amelia Avenue
Portsmouth, Virginia 23707
November 7, 1995

[Name and Address of Subject]

About three weeks ago I wrote to you asking about your experience with the effects of computers on your public library job. As of today I have not yet received your completed questionnaire.

If you have replied in the last few days then this letter will have crossed your reply in the mail; in that case, please disregard this letter.

This research has the potential for providing useful knowledge to people who work in libraries about the effects of computers on their jobs. Such knowledge can be a valuable and practical guide to action.

In the event that your questionnaire has been misplaced, a replacement is enclosed.

Your cooperation is greatly appreciated.

Sincerely,
Richard J. Harris
Fourth Mailing Cover Letter

609 Amelia Avenue
Portsmouth, Virginia 23707
December 5, 1995

[Name and Address of Subject]

I am writing to you about my study of the effects of computers on jobs in libraries. I have not yet received your completed questionnaire.

Knowledge of the effects of computers on library jobs has the potential to be useful to many people who are concerned with libraries. The usefulness of this knowledge depends on the accuracy with which our data reflects reality.

For these reasons I am writing again to ask you to complete and return the questionnaire as quickly as possible. In case your questionnaire has been misplaced, a replacement is enclosed.

Your contribution to the success of this study will be appreciated greatly.

Sincerely,

Richard J. Harris
Appendix Three

This appendix consists of a copy of the mail survey instrument.

HOW DOES COMPUTERIZATION AFFECT JOBS IN LIBRARIES?

Please help with a research project into the effects of computerization on library jobs. Your answers to the questions in this survey booklet will make an important contribution.

The questions take about 10 minutes to complete. They ask about your library's integrated library computer system, your job, and yourself. Your replies will be completely confidential.

Participation is voluntary. If you do not want to participate you need not do so. If you choose not to answer, you can still help by noting on the booklet that you do not want to participate, and then returning it.

When you have finished, please close the booklet on its long, open side with tape, and drop it in the mail.

Thank you for your help.
1. Which of these integrated library computer system functions are currently in use in the library where you work? (Indicate all which are in use) (INSTRUCTIONS: If you answer NONE OF THESE to this question, skip question 2 and go directly to question 3)
   - Online public access catalog
   - Acquisitions
   - Serials management
   - Binding
   - Circulation
   - Cataloging
   - Accounting
   - Collection development
   - None of these

2. What percentage of your time at work is spent working directly with the integrated library computer system? (Answer with a number from 0 to 100) _______

3. What percentage of your time at work is spent in direct contact with the public? (Answer with a number from 0 to 100) _______

PLEASE CIRCLE THE ONE ANSWER TO EACH OF THE FOLLOWING STATEMENTS WHICH MOST CLOSELY DESCRIBES YOUR JOB. IF A STATEMENT DOESN'T APPLY TO YOUR JOB, LEAVE IT UNANSWERED.

SATISFYING OR MOTIVATING ASPECTS OF YOUR JOB

4. Autonomy: The job allows freedom, independence, or discretion in work scheduling, sequence, methods, procedures, quality control, or other decision making.
   - Strongly Disagree
   - Disagree
   - Neither Agree nor Disagree
   - Agree
   - Strongly Agree

5. Intrinsic job feedback: The work activities themselves provide direct and clear information as to the effectiveness (e.g., quality and quantity) your job performance.
   - Strongly Disagree
   - Disagree
   - Neither Agree nor Disagree
   - Agree
   - Strongly Agree

6. Extrinsic job feedback: Other people in the organization, such as managers and co-workers, provide information as to the effectiveness (e.g., quality and quantity) of your job performance.
   - Strongly Disagree
   - Disagree
   - Neither Agree nor Disagree
   - Agree
   - Strongly Agree
Please circle the one answer to each of the following statements which most closely describes your job. If a statement doesn’t apply to your job, leave it unanswered.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Social interaction: The job provides for positive social interaction such as team work or co-worker assistance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Task/goal clarity: The job duties, requirements, and goals are clear and specific.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Task variety: The job has a variety of duties, tasks, and activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Task identity: The job requires completion of a whole and identifiable piece of work. It gives you a chance to do an entire piece of work from beginning to end.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Ability/skill level requirements: The job requires a high level of knowledge, skills, and abilities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Ability/skill variety: The job requires a variety of knowledge, skills, and abilities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Task significance: The job is significant and important compared with other jobs in the organization.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Please circle the one answer to each of the following statements which most closely describes your job. If a statement doesn't apply to your job, leave it unanswered.

15. Promotion: There are opportunities for advancement to higher level jobs.
   
   Strongly Disagree  Disagree  Neither Agree  Agree  Strongly Agree
   Disagree

16. Achievement: The job provides for feelings of achievement and task accomplishment.
   
   Strongly Disagree  Disagree  Neither Agree  Agree  Strongly Agree
   Disagree

17. Participation: The job allows participation in work-related decision making.
   
   Strongly Disagree  Disagree  Neither Agree  Agree  Strongly Agree
   Disagree

18. Communication: The job has access to relevant communication channels and information flows.
   
   Strongly Disagree  Disagree  Neither Agree  Agree  Strongly Agree
   Disagree

19. Pay adequacy: The pay on this job is adequate compared with the job requirements and with the pay in similar jobs.
   
   Strongly Disagree  Disagree  Neither Agree  Agree  Strongly Agree
   Disagree

20. Recognition: The job provides acknowledgement and recognition from others.
   
   Strongly Disagree  Disagree  Neither Agree  Agree  Strongly Agree
   Disagree

21. Job security: People on this job have high job security.
   
   Strongly Disagree  Disagree  Neither Agree  Agree  Strongly Agree
   Disagree

EFFICIENCY ASPECTS OF YOUR JOB

22. Job specialization: The job is highly specialized in terms of purpose, tasks, or activities.
   
   Strongly Disagree  Disagree  Neither Agree  Agree  Strongly Agree
   Disagree
Please circle the one answer to each of the following statements which most closely describes your job. If a statement doesn't apply to your job, leave it unanswered.

23. Specialization of tools and procedures: The tools, procedures, materials, etc., used on this job are highly specialized in terms of purpose.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

24. Task simplification: The tasks are simple and uncomplicated.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

25. Single activities: The job requires you to do only one task or activity at a time.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

26. Skill simplification: The job requires relatively little skill and training time.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

27. Repetition: The job requires performing the same activity(s) repeatedly.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

28. Spare time: There is very little spare time between activities on this job.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

29. Automation: Many of the activities of this job are automated or assisted by automation.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

USABILITY OF EQUIPMENT AND ATTENTION DEMANDS OF YOUR JOB

30. Lighting: The lighting in the work place is adequate and free from glare.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>
Please circle the one answer to each of the following statements which most closely describes your job. If a statement doesn't apply to your job, leave it unanswered.

31. Displays: The displays, gauges, meters, and computerized equipment on this job are easy to read and understand.

   Strongly Disagree Neither Agree Agree Strongly Disagree nor Disagree Agree

32. Programs: The programs in the computerized equipment on this job are easy to learn and use.

   Strongly Disagree Neither Agree Agree Strongly Disagree nor Disagree Agree

33. Other equipment: The other equipment (all types) used on this job is easy to learn and use.

   Strongly Disagree Neither Agree Agree Strongly Disagree nor Disagree Agree

34. Printed job materials: The printed materials used on this job are easy to read and interpret.

   Strongly Disagree Neither Agree Agree Strongly Disagree nor Disagree Agree

35. Work place layout: The work place is laid out such that you can see and hear well to perform the job.

   Strongly Disagree Neither Agree Agree Strongly Disagree nor Disagree Agree

36. Information input requirements: The amount of information you must attend to in order to perform this job is fairly minimal.

   Strongly Disagree Neither Agree Agree Strongly Disagree nor Disagree Agree

37. Information output requirements: The amount of information you must output on this job, in terms of both action and communication, is fairly minimal.

   Strongly Disagree Neither Agree Agree Strongly Disagree nor Disagree Agree
38. Information processing requirements: The amount of information you must process, in terms of thinking and problem solving, is fairly minimal.

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<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
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39. Memory requirements: The amount of information you must remember on this job is fairly minimal.

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40. Stress: There is relatively little stress on this job.

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41. Boredom: The chances of boredom on this job are fairly small.

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<th>Neither Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
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The last few questions ask about you and the library where you work.

42. How many people work in your library system? (If your system has branches, include all branch staff in your answer) _______

43. Does your job require a graduate library degree (MLS degree)? Yes □ No □

44. How many individuals do you supervise? (Answer with the number; if you don't supervise anyone, answer 0) _______

45. How many years have you worked at the library where you are now? _______

46. What is your gender? Female □ Male □

47. What is your age? _______
Autobiographical Statement


Colleges and Universities Attended


Publications

Harris, R. J. (1990). Use of miniMEDLINE(tm) by medical center faculty and residents. Poster presented at the annual meeting of the Medical Library Association, Detroit, MI.

Appointments

Eastern Virginia Medical School Library, Norfolk, Va.
Systems Coordinator, 1985-

Honors

Academy of Health Information Professionals, Senior Member, 1990-
IIAA, the National Honor Society for Public Affairs and Administration, 1987.