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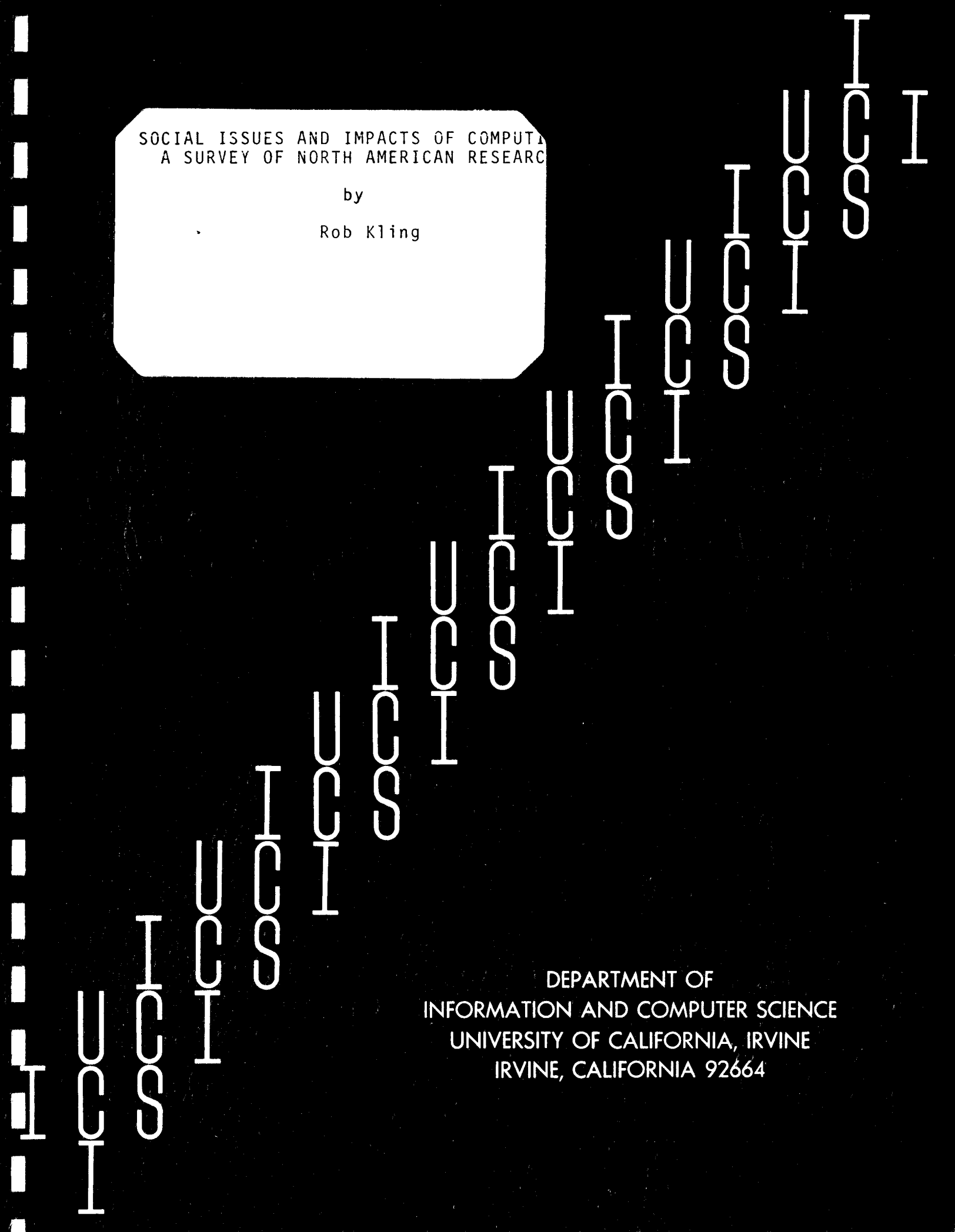

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1.0 INTRODUCTION

Digital electronic devices come in all shapes and sizes, from alarm wristwatches with programmable calendars through worldwide networks of large-scale timeshared computers which are coupled with telephone and satellite links. Each year more sophisticated and technically reliable devices appear on the market. Graphic terminals with color displays are used in attempts to add interest to dull numbers, and monochromatic terminals can be found in many offices as standard pieces of equipment. The U.S. computer industry accounts for $30 billion/year revenues, and is growing at 10-15% each year. Almost everyone who has had substantial contact with computer-based systems is impressed by their capacity to store and flexibly manipulate vast amounts of information.

The increases in storage and speed of digital computers over their mechanical precursors and people have led many analysts to view digital computing as a technology with possible social repercussions as potent as those of the automobile and telephone. It is commonplace for people who think and write about the social effects of computer-based technologies to speculate about the repercussions of new computing modalities, from large databases [51], through network information services [42], to artificial intelligence [83]. Often there is little choice but to speculate about new technologies since they have not been built and placed in their host social settings. One

constructive role of prospective analyses, to help inform affected parties so that they can make better social and technical choices, requires that one deal with emerging technical and social arrangements. Postmortem analyses may be more accurate, but they are of substantially lesser utility.

Speculative analysts tend to focus upon the capabilities, potential benefits, and potential harm of new technical developments. Consider the case of electronic funds transfer systems. Appreciating the ways in which automated teller machines can enable the public to bank any hour of the day or night enables bankers to develop a new set of services. Also appreciating how real time funds tranfer systems may be susceptible to "credit blackouts" alerts bankers, technologists, and public alike to potential inconveniences if these technologies are developed haphazardly [26].

Actual patterns of technology use often differ from extreme potentials. Television in the U.S. is neither as aesthetically rich nor as dismal as the programming of the medium could be. Programming patterns are as strongly influenced by the dominance of three commercial networks which "counterprogram to increase their ratings and advertising revenues as they are by the technical capabilities of television production and viewing equipment. Analyses of television programming which focus almost

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exclusively on the technical capabilities of the medium and neglect the role of television business practices in influencing programming practices cannot be taken seriously. While analyses of television written before 1945 could be excused for neglecting the effects of social milieu on programming, analyses of the 70's cannot.

Computing is much like television; its uses are as strongly influenced by the social milieu in which it is used as by technical capabilities alone. Generally, the development, uses, and impacts of new technologies, like television and computers, are strongly modulated by the social milieus in which they have been adopted. During the last decade, there have been a number of careful studies of the social influences upon computer use, and of the influences of computing on social life. This article provides a brief introduction to these studies which may give helpful insights to policy makers, technologists, and scholars interested in the social repercussions of computer-based systems.

The first digital computers in the United States were in use 30 years ago. By 1975, nearly 200,000 computers were installed nationwide [82] and some large firms devote as much as ten percent of their budgets to computing activities. Most public agencies serving populations over 100,000

also automate many of their operations*.

In the United States it is possible to study the impacts of existing computer-based systems because there are so many. We can ask not only what the potentials are, but also where the problems have been, and where the payoffs are. This provides empirical bite, because we can look at what the people who promoted these systems expected, what they actually received, and who was affected and how [25]. Thus, studies of actual computer systems can help shed a great deal of light on the interplay between these complex information technologies and the social settings in which they are used.

* Almost all cities and counties of greater than 100,000 population -- several hundred local governments -- have computer installations, and the average city has about forty different computer applications in finance, land use planning, police, and tax collection. The federal government is intensively automated with over 8600 computers operated by the executive agencies [82]. Each of the cabinet agencies has registered dozens of automated data systems in compliance with the Federal Privacy Act of 1974. For example, the Department of Health, Education, and Welfare maintains 693 data systems with 1.3 billion personal records about the recipients of social services. A subcabinet agency the Veterans Administration, maintains 52 data systems with 156 million records on the beneficiaries of veterans benefits. While most of these applications are recordkeeping, check processing, and billing applications, some agencies maintain more sophisticated computer uses. The Veterans Administration has programs to verify the eligibility of applicants for educational benefits. The Internal Revenue Service runs programs to automate portions of tax audits for individual tax claims. The U.S. Navy has programs which schedule preventive maintenance on field equipment and which reorder spare parts when centralized stocks fall below prescribed levels. Staff in the Department of Energy can utiliize a variety of models which relate energy prices and consumption.

The major focus of this paper is the exposition of some important research studies of the social issues and impacts of computing which have been published in the 1970's. While studies of the social issues and impacts of computing may be viewed as simply the case of one complex technology to be contrasted with other technologies in advanced industrial societies, that will not be done here. Studies of computing have developed a peculiar status. As the reader shall see, the computing studies elaborated here typically focus only on computing, even though computing is casually contrasted with other information technologies. The reasons are largely pragmatic. Analysts who undertake studies of computing are often very keenly aware of the debates over the social role of complex technologies in the United States. As citizens and scholars, they read about nuclear energy and solar cells, about automobiles and bicycles, about television, photocopiers, and pocket calculators. For most analysts, computing is often a concrete instance of some more generic technical category: simulation models or program budgeting may be viewed as instances of quantitative management techniques, electronic funds transfer systems may be viewed as instances of highly integrable public technologies which touch the infrastructure of American society. But each kind of technology raises unique issues. Disposal of wastes and explosions are more salient in discussions of nuclear energy than they are in discussions of computing. Personal privacy is more salient in the case

of computing than for monorails and ten speed bicycles. Each technology raises a unique bundle of concrete social and technical issues, which are best addressed within studies emphasizing that particular technology The net effect is that the literature on technology and society includes relatively few generic accounts [80] and vast literatures specialized around different technologies. Analysts are often drawn to studies of the social aspects of computing both because they view computing as a potent technology and because such studies provide an important opportunity to study social change in modern organizations and societies. However, in order to gain intellectual focus, these same analysts will focus upon some specialized technical arena (e.g., recordkeeping practices, analytical methods, communication systems). The best analyses are developed with keen sensitivity to the broader themes which they typify. The value of good studies of computer-based information systems in public policy-making will increase as they draw upon the best studies of policy formation and execution and the role of other technolcgies in policy development.

For simplicity, this article focuses exclusively upon studies of computing. Understanding the approaches to studies of computing developed in the 50's and 60's will help the reader appreciate the significance of more recent contributions. Also, the studies of the 60's initiated modes of discourse which are still common today, even though

they have been superseded by sharper conceptual approaches. We will turn to the earliest studies of computing first, before engaging in our major topic.

2.0 EARLY STUDIES OF COMPUTING: 1950- 1969

The earliest literature on the social impacts of computing in the United States was largely speculative. Studies were conducted within two intellectual traditions. Analysts of the management science tradition were concerned with ways that computer based systems provided new resources for decision-making for managers in large organizations [71]. They focused upon the new opportunities provided by computer-based systems, and identified with the interests of the top managers of computer-using organizations. In contrast, analysts of a humanistic persuasion identified with a broader public and to emphasize the social problems that could easily accompany casual automation [88].

Between 1950 and 1969 these two perspectives dominated studies and discourse about the social impacts of computing. Management scientists were concerned primarily with the potential new uses that could be made of computing in a variety of settings. There was a litany of uses - - computer assisted instruction, management information systems, automated decision systems, transaction processing, etc. One of the key questions they asked was how systems

could be designed for effective use by managers, to render organizational activity more efficient and effective. The major research studies were either speculative analyses [71] or "experimental" development of prototype systems [35]. It is hard to find studies that systematically evaluate the actual impacts of specific developments that were undertaken in the 60's. Some systems didn't meet their original goals, but those were viewed simply as opportunities for learning and designing better technologies [1]*.

Analysts in the humanistic tradition emphasized the social problems that could result from haphazard, widespread automation. They focused upon losses of individual privacy from large scale information systems [51], the spread of dehumanizing jobs in automated workplaces [16], and the loss of jobs overall in the economy through the efficiencies of automation [50]. This early literature illustrates how

* Studies in this tradition had both undertones of optimism and of cynicism The optimistic assumption is that social and organizational life is most easily altered through technical fixes. New information technologies might improve the effectiveness of organizations and the rationality of decision making. The cynicism lay in the sentiment that the lay public, including most staff in public and private organizations, were reluctant to become more rational, and that sophisticated technologies would rarely be truly appreciated and properly used. This mixture of sentiments allowed any empirical findings of computer use to be casually accepted. If the staff of a computer-using organization found automated decision aids to be helpful, that fit the optimistic sentiments of management science theorists. If organizational staff felt overloaded with unusable information, either foolish information consumers or system designers were clearly at fault. In all cases, regardless of the actual patterns of computer use, the theoretical position could be rationalized to fit new events.

questions of computer use are politically conditioned. Weiner's "The Human Use of Human Beings," first published in 1950 [88], devotes a chapter to information control. Weiner was not concerned with the problem of privacy as we understand it today -- the abuse of personally sensitive information by large organizations. He was concerned about diminishing exchanges of information between scientists with the onset of the cold war. The privacy issues in the United States really became public in the form that we now understand in the late 50's and early 60's, after internal purges of communists and communist sympathizers in the 50 s which were popularly associated with Senator Joseph McCarthy. In a shifting political climate in which people became concerned about the kinds of political uses to which personal information could be put, different concerns about computing emerged. At the time there were no documented abuses of computing, but many people appreciated how information about personal activities could be a rich political resource and could be used harmfully.

People's sensitivity to the larger culture and to its political institutions influence their perceptions about what to look at in a new technology New technologies are like Rorschach tests; people project their faith or distrust in older technologies onto newer ones. People who feel that cars, telephones, stereos, cameras, jet engines, nuclear energy -- have been benign, tend to believe that computing will be a benign technology and ought to be

developed rapidly In contrast, people who are disturbed by the dilemmas of major industrial technologies also look for possible problems with emerging information technologies.

Humanistic analysts published both speculative and empirical studies. Empirical studies of the role of computing in employment and of computing in the workplace were initiated in the late 1950's. Several studies were conducted of early applications in accounting offices to learn whether people were displaced from jobs [4,44]. Empirical studies were very carefully done with an organization as the unit of analysis. The studies found that people were displaced from clerical work but that workers weren't fired. Rather, they tended to be retrained them for other jobs while employment was allowed to drop through normal forms of attrition (e.g., retirement, family moves). Employers feared that if they fired workers when computing was introduced, they would stimulate a public reaction against the technology, so they adopted benign employment policies. These findings muted subsequent concern about computer use leading to massive uemployment*.

Another set of empirical studies in the workplace dealt with the character of automated jobs, and the focus was largely on clerical jobs [4,16,45]. Some of the studies showed that the clerical jobs tended to be constrained, and

* Long-term effects of structural unemployment may still appear in the economy This has not been systematically studied, and cannot be ruled out [16].

some showed a great deal of variability -- some jobs enlarged, some jobs constrained, some made more interesting, some made more routine and dull -- without much systematic explanation of why jobs were differently altered.

In the popular imagination, humanistic analysts are "softminded" and management scientists are "toughminded." Oddly, computing impact studies executed within these two analytical traditions do not fit the popular stereotypes. Management scientists avoided hard-headed evaluations of the systems they proposed. Humanistic anslysts were more likely to conduct empirical studies to learn systematic and concrete facts about the human repercussions of computer use. In the 1970's, the management scientists have developed greater empirical sensitivity, as we shall see.

3.0 CONTEMPORARY STUDIES: 1970-1978

Two books mark the transition from the earlier period to the current. Whisler's comparative studies of the impacts of computing on organizational activity in the life insurance industry [87] was a milestone. Whisler was the first scholar within the management science tradition to undertake a systematic empirical study of the impacts of computing on the structure, worklife, and decision-making within organizations. Whisler claims that insurance firms centralized their administrative offices when they

automated. The locus for making decisions moved upward in the organizational hierarchy. And managers often had more robust and interesting jobs after automation, while clerical jobs were often diminished in scope, variety and autonomy

The second book that marks the shift into the 70's is "Social Issues in Computing", by Gotlieb and Borodin [12] which summmarizes the best empirical studies of computing. Gotlieb and Borodin avoided largely speculative analyses, and worked wherever possible with hard data, utilized studies done by others, provided some intellectual coherence to topics that range from privacy to the impacts of computer-based systems on work and decision making in organizations. The book neither excites the imagination of the reader with new social possibilities afforded by computer-based technologies and utopian reforms, nor does it incite righteous indignation over the dehumanizing influence of computer use on every front. It is a self-consciously sober account which carefully assesses the social issues and impacts of computing without fanfare.

Place Tables #1 and #2 about here.

Social transitions are rarely abrupt. Scholarly modes also alter over decades. In contrast with the 50's and early 60's, studies in the 70's have been markedly more

empirical and have developed more sophisticated conceptualizations of the social features of computing. Speculative studies still appear, and are essential for examining the potential uses and effects of new computer-based technologies. But the better speculative treatments are carefully grounded on empirical studies [24,26,65]. In addition, a wider array of topics have been examined (Tables #1 and #2). The studies of the 1970's are less easily characterized by management science or humanistic perspectives. The best studies combine humanistic sensitivities for the differing values and interests of people who are affected by new technologies with an appreciation of the work settings and institutional demands experienced by managers in computer-using organizations. They also are sensitive to the information processing possibilities and technical limitations of new computer-based systems. These improvements in empirical sensitivity, topical scope, and conceptual sophistication characterized some studies published in the late 60's [9, 87]. They became more common by the late 70's.

Nevertheless, ideological and theoretical cleavages of previous decades reappear in contemporary studies. Some analysts tacitly accept the legitimacy of the computer-using institutions they study and their hierarchies of authority, and they identify with the interests of top managers [70-73, 87]. Other analysts identify with the clientele of an organization as well as with its staff, hold no particular

fidelity to the interests of top managers in contrast with other participants, and believe that few accounts of organizational life can be taken at face value [25, 39, 64]. Moreover, analysts of this persuasion often view organized social life as arenas for conflict, both within and between groups. They view differences of values and interests as critical elements in any study of the social role of technology. These differences mirror differences in political ideology in American society, and in the variety of social theories which analysts adopt in their study of social life in America [69,81].

This section briefly sketches some studies that deal with representaive topics: the conditions under which computer-based systems are adopted (innovation research), the conditions that lead to the development of usable systems (implementation research), the impacts of computer-based systems on worklife and decision-making in organizations, and the social issues raised by computing.

3.1 Computing In Organizations

There are many areas of social life where computing has had a visibly profound impact in the United States which have not been systematically studied. Computing is used routinely as a tool in most American scientific laboratories. In chemistry and physics both experimentalists who collect data, and theorists who have exhausted closed form solutions for the equations that model the systems they want to study rely upon computing. The theorists have turned to numerical approximation to study more complex physical systems than they could if they had to rely upon tables of integrals and solve differential equations by hand methods. In sociology and political science, survey research has become dominant. For both collating survey data and for executing multivariate analysis (e.g., multiple regression) computer systems are routinely used.

But these impacts have not been a focus of study. Rather, many studies have concentrated upon computer use in private and public organizations. The reasons for the focus on computing in organizations are largely pragmatic. Most computer-based systems have been adopted by organizations. Even computer systems with which the public has direct contact such as point-of-sale terminals and automated tellers are administered by organizations. Thus organizations are a sensible focus for understanding the

role of computing in social life. In advanced industrial societies, large organizations play a dominant role in the lives of much of the public, particularly in urban areas. Since computer-based systems are used by many organizations to record transactions with their clients, organizations become a natural focus for certain issues affecting the relations between them and the public [74]. Since the nature of organizations, their size, scope, and institutional style, is a potent force in modern life, the influences of computer use upon these facets of organizational life are also important.

3.1.1 Innovation Studies -

Technologists often hold pleasingly simple conceptions of the diffusion of technical innovations [42]. Successful technologies meet a "need" of a clientele (individuals or organizations). As people learn to appreciate that a new technology meets some "need" better than its alternatives, and as the costs of obtaining the technology decrease, the technology is adopted on a large scale. Patterns of adoption are not uniform; some consumers purchase a technology before its use becomes commonplace. Early adopters are thought simply to be wiser and richer than late adopters. Such working theories have several roles. They help focus the attention of technologists on cutting the

costs of deploying and using new technical systems. (As costs diminish, beneficial technologies will "naturally" become adoptable by social groups regardless of wealth, and maybe wisdom.) But primarily such theories are asserted with the tenor of scientific statements. If they are at all valid, they should provide good predictions for which individuals or groups will adopt a new computing technology (e.g., of those with a given need," the richer and wiser).

In a recent study of the adoption of computer-based systems in American local governments, Danziger and Dutton carefully examined the role of institutional needs and the social features within and outside the organizations to predict the rates at which different governments would adopt computing applications[8]. By comparing rates of computing adoption within similar kinds of organizations, they were able to use organizational domains (population of the jurisdiction) as an index of need." Most American counties for example, administer property taxes. One can assume that the utility of computing to help ease the burdens of tax roll preparation would be similar for counties with similar populations. Danziger and Dutton found that governmental size and complexity (i.e., "need") account for about half of the explained variance in levels of computing adoption. The other half of the explained variance is accounted for by elements of the government s milieu (e.g., presence of outside funding for applications) and the social milieu inside the government agency (e.g., reliance upon

professional management practices, variety of participants influencing decisions to adopt computing). This study clearly indicates that organizations adopt computing not simply based upon economic conceptions of task demands, but are also influenced by a variety of specifiable social features*.

Laudon's insightful case studies of four police systems in state and local governments [39] illustrate how these systems served the interests of the particular elite groups in the governments which adopted them. Sometimes the introduction of these systems were instruments of bureaucratic politics. For example, one state governor wished to establish a state attorney general's office. The local police departments were extremely autonomous and their staff didn't want a state attorney general's office. The governor offered a computerized system as a quid pro quo to help establish the attorney general's office. He offered to develop a state computer system to keep track of wants, warrants, and criminal histories for all jurisdictions within the state. Its administration would be centralized. He offered to provide information services to the local police agencies in exchange for having an attorney general's

* Pettigrew examined decisions to select new computer systems in a British manufacturing firm [59]. He found that technical choices made by the board of directors were influenced by their trust in different advocates more than in the technical merits of their proposals. Staff with good personal relations with board members were most likely to have their proposals for choice of vendors or kinds of equipment accepted, even when their adversaries in the firm had better cases on procedural or technical grounds.

office to administer the system. Laudon views new computer systems as political instruments which are selected to fit the political contours of existing organizations with their own ongoing conflicts and coalitions.

Often the staff of organizations which adopt computing will point to the savings of staff, internal efficiencies, and increased managerial control provided by computing [26,64]. These "technical benefits" are used to justify the adoption and use of computing technologies within the organization and to outside parties. However, careful studies of the actual payoffs of computing within organizations indicate that other rationales often dominate the decisions to adopt or sustain computer-based systems. Concerns for increasing the administrative attractivenss, rather than internal administrative efficiencies helped sustain an otherwise relatively useless client-tracking information system in a welfare agency in a medium-sized American city, "Riverville" [25]. The agency appeared more efficient to federal auditors and was able to maintain a steady flow of funds since the presence of computing enhanced its image of effective administration. In Kling's current studies of engineering simulations conducted within a multinational construction firm, WESCO (a pseudonym), similar patterns are sometimes found. Chemical engineers utilize simulations to help develop the design parameters of chemical processing plants when they seek increased technical sophistication in their analyses. Sometimes they

seek simply more precise estimates for the sizes of pumps, compressors, and costly special equipment. But there are also occasions when engineers have trouble convincing auditors hired by their clients of the efficacy of their designs. In some such cases, engineers have moved from using hand calculations to employing available simulation programs to help snow the auditors. The calculations look precise and sophisticated. Since the firm s simulation programs are proprietary it is also more difficult for auditors to double check the correctness of the calculations or the assumptions made*.

In the language of management science, one could say that engineers at WESCO and administrators in Riverville have found computing "applicable" to decisions in their organizations [42]. But much is lost with such banal characterizations. Sometimes people and groups choose to

* These simulations utilize tables for storing some properties of materials (e.g., specific heat) and use special thermodynamic correlations for computing others. Properties of materials change in different temperature ranges, and it is impossible to tell which value is used without careful inspection of the programs. This is not a trivial matter since some of the chemical processes designed by WESCO operate near absolute zero while others operate near the boiling point of water. The chemical engineers also can select among a dozen thermodynamic correlations to compute other properties. These correlations are proprietary and an outside reviewer cannot confirm whether the correlation selected for a particular analysis was truly appropriate. Even engineers within the firm will differ in their judgements about which correlations should be selected for a particular set of physical conditions. Plant design parameters can vary as much as 20%, depending upon the correlation chosen. The engineers tyically work within 10% tolerances, and selection of an appropriate correlation can be technically and substantively important.

utilize computer-based systems because they value expected technical benefits such as more precise calculations, speedier information flows, and more flexibly organized reports. On other occasions, computer use serves as an instrument of bureaucratic politics [19,21 25,39]. Computing applications used as political instruments do not easily fit the highly rationalized accounts provided within the management science tradition [71]. Many analyses of computer use developed within the management science tradition are intellectually impoverished and sociologically naive because they faithfully focus upon the technical payoffs of computing in organizations and neglect patterns of use that are inconsistent with an economic conception of organizational activity. But to the extent organizational politics influences the adoption and use of computing, its dynamics must be part of any systematic understanding of the antecedents or consequences of computer use in organizations.

Understandings of the interplay between computing and the political order of organizations can prove helpful for computing promoters. Kraemer [36], for example, has developed an insightful analysis of the social dynamics of software transfer It is commonly held that computer-using organizations can benefit from adopting computer applications which are developed by an outside vendor or other organization if they can purchase them for a modest fee. Computer scientists and federal research supporters

have paid serious attention to schemes for developing machine independent software, to help diminish the costs of transferring applications across organizations. Kraemer also has studied the actual rates of software transfer between American cities [36]. He found that a typical city has automated about 40 applications, but in general only one has been transferred in With John King, he also studied federal projects in which cities were funded specifically to transfer applications and found that applications were rarely transferred to other cities [38]. One can interpret these findings in a number of ways. One can bemoan the ignorance of public officials and wish that they were wiser and more innovative. More sensibly Kraemer has analyzed the incentives provided for particular groups in an organization to transfer in an application. In most organizations, transferring in a new application does not provide strong rewards for a local computer group compared with local development. A manager who supervizes a local development can increase, or at least maintain, his staffing, can increase his budget, and can become an expert on yet another critical operation. Given the development bias of the computing world, a new developer may gain additional prestige compared to an actor who merely transfers an existing application. Together, these create a bias of mobilization against transferring in new applications. His analysis differs from the rational economic theory of the firm that underlays the analyses of

management scientists who assume that software transfer is "natural." And it has convinced officials in the U.S. Department of Housing and Urban Development not to support information repositories for transferable" software unless they could provide other resources to help alter organizational rewards to favor application transfer.

All of these studies point to the potent role that an organization's political order can play in influencing whether computing is adopted, which technologies will be selected, how they will be developed, and whom they shall serve.

3.1.2 Implementation -

Computer-based systems may be adopted by the staff of an organization, but may still be difficult to use easily. Casual observations about computer-based information systems which produce voluminous or unreadable reports are commonplace. Scholars studying "implementation" have tried to identify those systematic features of the technology, the organizational setting, or the process of development which lead to useful systems [19, 22, 43]. These studies repeatedly show that involving the people who use a computer-based system in its design leads to producing systems which are better accepted. Unfortunately, "user involvement" has become a cliche, and both "user" and

"involvement" are ambiguous in referent. The better studies differentiate kinds of 'users." Managers of computer-using departments who occasionally see computer-based reports but who must authorize system developments have a different relationship to systems than do staff analysts who generate reports or clerks who enter and retrieve individual transactions. Similarly "involvement" can range from being informed about design decisions made by technical staff, through actually creating design specifications. The research indicates that people who use computer-based systems will appreciate them to the extent that the systems help them meet their task demands and to the extent they feel some control over their system's behavior.

3.1.3 Impacts Of Computing On Decision-making -

Simon has clearly been the most influential theorist to link computer-based systems and decision-making in organizations. The conjunction of computing and decision-making is natural for Simon, since he has developed a view of organizations which emphasizes people's activities as decision-makers and problem solvers [70, 71, 73]. Simon's major contribution to classical organization theories was to alter the conception that people are only capable of behaving in a perfectly rational manner. Nevertheless, he shares with economic theorists of the firm

a view of organizations as purposive systems of action in which actors pursue generally articulable goals. For Simon, there need not be consensus over goals -- simply a sufficiently strong "controlling coalition' to insure that important goals are worked upon. Simon notes that people have limited abilities to attend to information, to remember, and limited time to work on given problems For Simon, people 'satisfice," by selecting the best alternative solution to a problem they can find in a given time rather than waiting to find an optimal solution. Data and methods which help focus attention and evaluate choices improve the technical performance of a decision-maker. Simon has argued that computer-based information systems can help participants in organizations act more rationally by enabling them to compensate for their information handling weaknesses [73]. To the extent that computer-based systems can help them organize and filter larger volumes of information and that simulations enable them to consider a wider variety of complex dynamics simultaneously Simon views them as helpful instruments [72, 73]. Simon s claims have rarely been tested empirically but they have provided the framework for much of the theorizing about the social roles of computer-based information by management and computer scientists.

An example of this perspective is provided by a recent account of computer-based models by Licklider and Vezza [42]:

> 'Computer-based modelling and simulation are applicable to essentially all problem solving and decision-making....they are far from ubiquitous as computer applications...The trouble at present is that most kinds of modelling and simulation are much more difficult, expensive, and time-consuming than intuitive judgement and are cost-effective only under special conditions that can justify and pay for facilities and expertise.'

These casual explanatory comments typify the weaknesses of much technical commentary on the social effects of computer-based technologies. They embody a simplified version of Simon's decision-making perspective, and lack the attention to social context which Simon, on occasion, provides. Neglecting the obiter-dicta claim that modelling and simulation are "applicable to essentially all problem solving and decision-making, presumably including ethical decisions, one is left with an odd account of the problems of modelling. Models "are far from ubiquitous," and "the trouble is" they are difficult and costly to develop and use. But the appropriateness of modelling is unlinked to any discernable social setting or to the interests of its participants.

Presumably, differences in social settings make no difference*. Scholars who have carefully studied the conditions under which computer-based technologies are adopted and used have found that the character of social settings is a potent influence [8, 13, 23, 25, 39, 63]. Whether models and simulations are applicable to essentially all problem solving and decision-making" by virtue of helping to inform decisions or to justify and cloud the bases of decisions made on other grounds depends in part on the degree of consensus over means and ends held by the active participants in a decision arena [13, 23]. Exactly what special conditions" Licklider and Vezza believe "can justify and pay for facilities and expertise" cannot be discerned from their account. The reader is provided with an ambiguous analysis, couched in rational rhetoric, but which can be interpreted within broad political understandings of organizational action. It draws no insights from the studies of the uses and impacts of modelling on decision-making and legitimation in organizations. And it pretends expertise through its dispassionate tone and publication in a prestigous engineering journal. This section examines some of the better studies of the role of computer-based systems as

* Simon waffles on the role of social settings in altering the roles played by computer-based systems. In Organizations, he and March indicate that analytical problem solving will occur under special organizational conditions. However, when he recommends the use of computer-based systems, he doesn't qualify his advice by attention to social context [72]. See [23] for a critique of Simon's analyses.

decision-making aids to organizational participants.

Greenberger, Crenson, and Crissey [13] investigated the use of computer-based modelling systems as guides to policymakers in public agencies. They studied the role of econometric models in developing U.S. fiscal policy, Forrester's WORLD III model which stimulated the "limits to growth" debate in the United States, and an operations research model for locating fire stations used by the City of New York. An advocate of rational modelling would assume that models such as these could and should be used by policymakers to help sharpen their perceptions and help select among alternative policies. Greenberger, Crenson, and Crissey rarely found that policymakers' choices were influenced directly by model-based analyses. Political actors often used models, but they were employed to generate support for policies selected in advance. When modelling efforts were influential in a decision arena, it was often the modeller who was called upon to provide sage advice rather than modelling runs that informed decisions. Also models helped indirectly to inform decisions by stirring partisan debate. While "modelling as advocacy" was best illustrated through the "limits to growth debate" and through their account of Laffer's predictions of the U.S. GNP in 1971, modelling as a tool of advocacy is commonplace. Under such conditions, the most constructive role for models has been to help advocates of different positions to use models to help make their case and to critique the

assumptions of their antagonists.

Greenberger, Crenson, and Crissey's subtle analyses of each modelling effort indicates that details and structural arrangements differ across problem domains and social arenas. Bargaining over fire-house locations in New York City differs from predictions of the Gross National Product in response to an increase in the Federal Reserve Board's prime interest rate. City councils and Congress, firemen's unions and bankers, act differently But in each case, Greenberger, Crenson, and Crissey take the world of policymaking as given, with its short time horizons, fluctuating attention to issues, and attempts of participants to mobilize support, placate critics, and displace problems that don't require immediate attention. They find that the modelling does not easily fit the fragmented world of public policymaking. They note that modelling efforts often require good definitions of the questions to be asked, while policymakers are often working with shifting definitions of the dilemmas they face. In addition, modelling efforts often require several years to design, program, and fine tune. Many policy matters are resolved much more rapidly; indeed, many political actors are out of office or transferred to other jobs within any two year period. Lastly they note that models help an actor gain intellectual mastery over a given problem domain by integrating many factors and their interactions. In contrast, political arenas, particularly in the Federal

government, are designed to manage problems by factoring them into chunks which can be delegated to different administrative and regulatory agencies. Despite these "misfits" between model based analyses and the dynamics of policy-making, Greenberger, Crenson, and Crissey are optimistic about the value of modelling efforts and recommend strategies to improve their utility they focus upon social strategies that institutionalize the development of specific models which may be used to answer recurrent questions, and to intensify the uses of countermodelling and multimodelling. They clearly eschew explanations of the failures of rational modelling efforts which hinge on the technical weaknesses of contemporary models.

In a study of the use of automated information systems in municipal policymaking, Kling [27] found similar patterns. Automated information systems that provided demographic, economic housing, and transportation data were available to most of the city councils, planning staff, and top administrators in the 42 cities he studied. He found that computer-based reports were provided to city council several times a year, on the average. In about half the cities, these reports never lead to clearer perceptions or surprises about city conditions. In less than 10% of the cities did these reports generally provide clearer perceptions or surprises to city council members. However, in 35% of the cities, the reports were generally used to provide legitimacy for decisions and perceptions of city

councils. In about 10% of the cities, the reports were generally used to gain publicity for programs In about 25% of the cities, these reports were sometimes used to legitimize perceptions and gain publicity for programs supported by council members. These patterns could be due to the primitive state of automation in American cities. If cities utilized more sophisticated data resources, then perhaps policymakers would find more surprises in the reports they receive and be less likely to use them as political resources. Kling developed several measures of the degree and richness of automated data systems to support policy analysis in each city. He found that in more automated cities, policymakers were more likely to report clearer perceptions and surprises from reports based on automated analyses. However, he also found that policymakers in more automated cities were also more likely to use these same reports to legitimize their perceptions and gain publicity for their preferred programs. Kling interprets these findings as indicating that computer-based analyses are a social resource which are used like other social resources by political actors. They don't alter the policymaking style of political bodies; they are used as resources within a given style.

In a recent study of the use of information systems by mayors, city managers, and chief administrative officiers in American local governments, Dutton and Kraemer also found that usable computing was crafted to fit the local milieus

[10]. They argue that the literature on management information systems emphasizes two ideal models for organizing usable information systems. The data-based systems are supposed to provide reports of comparisons over time and across programmatic units from integrated data files which contain information on an organization's operations. Such systems, typified by integrated financial accounting or land use inventory systems are supposed to help actors spot emerging problems in their organization and its environment. In contrast, decision-based systems aim to help actors solve specific problems through the use of sophisticated analytical systems for which sophisticated information storage and retrieval are not critical. The archetypical applications are models for financial forcasting and facility location. They claim that many analyses of management information systems using these models mislead their readers because they are "dominated by images of sophisticated applications, advanced technology long term potentials, or particular ideal types of information systems" [10:206]. In contrast with these approaches, Dutton and Kraemer find that reporting systems used by chief executives in American local governments provide relatively simple reports from fragmented. operations-based files. Current balance reports and personnel listings typify their data content. While these applications are typically designed to meet the pragmatic operations demands of different departments, they can be

used to generate information useful for top managers. They call this approach management oriented computing (MOC) and indicate that it is the most common source of computer-based reports used by chief executives in local governments. They argue that

> "MOC is an adaptation to the decision agenda and available technology of many local governments. Most decisions made by managers are routine, in the sense that they recur frequently incremental, in the sense that they involve small changes from current conditions, and remedial, in the sense that the changes they are movements away from some undesirable condition rather than movement towards some desired condition [10:209]."

In the literature on management information systems, Dutton and Kraemer found explanations that hinge their effectiveness on: (a) the sophistication of computing; (b) the values and attitudes of top managers; (c) control over computing; and (d) the organization's external environment. In testing these alternative explanations, they find that the values and attitudes of top managers play a significant role in the extent to which they (and their staffs) receive computer-based reports. They found that control over certain kinds of computing decisions, particularly over computing expansion decisions, but not over the operations of computing facilities, was an

important influence on the production of management-oriented reports. The sophistication of computing systems was not found to be a significant explanation of the managemnt use of computing. Lastly they found that the character of an organization's external environment does not significantly influence the extent of management oriented computing. When combined with Danziger and Dutton s findings that half of the variance in computing adoption rates is explained by the size and complexity of an organization's environment, these findings take on greater significance. While 'need may help explain the extent to which organizations adopt computing, the kinds of uses to which computers are applied depend much more on the political order within the computer-using organization.

These studies indicate that computing can play multiple social roles in organizations which adopt them. While the studies cited here have been carried out within public agencies, there is no reason to believe that the internal organizational dynamics of private organizations are substantially different. For example, Pettigrew's study of computing adoption decisions in a private manufacturing firm indicates that office politics can be as pervasive as those in public agencies [59]. In an effort to implement an analytical model to assist the officers in a Boston bank in locating new branches, Gibson also discovered actively "political" modes of decision-making at the higher corporate levels [11]. Simon indicates similar perceptions when he

suggests that the manager in a more automated firm

> "will find himself dealing more than in the past with a well-structured system whose problems have to be diagnosed and corrected objectively and analytically, and less with unpredictable and sometimes recalcitrant people who have to be persuaded prodded rewarded and cajoled.... Man does not generally work well with his fellow man in relations saturated with arbitrary authority and dependence, with control and subordination, even though these have been the predominant human relations in such settings in the past. He works much better when he works with his fellow man in coping with an objective, understandable, external environment [71, 73:132-133].

Despite these hopes that automation will help diminish the abrasive conflicts within organizations, there is no evidence that computer-based systems have "depoliticized" the organizational settings in which they are employed. In a recent analysis of computing management, Strassman observes:

> "The motivating forces behind every game in the systems field are the achievement of power, influence, 'political posture,' high-compensation levels for its members, and a disproportionate share of the corporation's resources [79]."

There is a vast literature on the design of information systems for organizations. But remarkably few studies actually evaluate the use of systems in place. And only a handful of these treat the interplay between automated information systems and the social order of their host organizations*. The studies which have been summarized here indicate that computer-based information systems that are regularly used and usable, are grafted into the ongoing politics of their host organizations. Rather than altering the character of social "relations saturated with 'arbitrary' authority and dependence," automated systems are best received when they buttress the positions of organizational actors with substantial power [10, 21, 27].

3.1.4 Impacts Of Computing On Worklife -

There is no paucity of images to portray the effects of computing on work life. Mills [52] for example, indicates that computing routinizes white collar work and weakens the power of lower level participants in an organization. In contrast, Bell [2] and Myers [55] provide enthusiastic accounts of computing as an aid to 'knowledge work.' In particular, they emphasize the extent to which

* In addition to the studies described here, see Colton's studies of computer applications for police [6], the studies of Kling [25] and Laudon [39] described earlier, and Stewart's studies of large scale decision-support systems in British firms [77].

computer-based technologies enlarge the range and speed at which data is available. Myers, for example, concludes that, computing will help relieve 'specialists and professionals' of the time-consuming and repetitive parts of their work."

Despite the influence of these theorists, these accounts are relatively remote from empirical studies of computing. Over the last two decades, scholars have undertaken a variety of empirical studies of computing in the workplace [16, 44, 87]. These studies of clerks, supervisors and managers vary in their findings. The earliest studies [4, 16, 44] suggest that computing has relatively constant, and sometimes deleterious effects upon workers whose jobs depend upon the preparation and use of computer-based reports. More recent studies indicate variable effects of computing on the job characteristics of computer users. For example Whisler [87] indicates that managers' jobs are enriched by computer use while clerical jobs are more constrained.

Kling recently investigated the impacts of computer use on the character of jobs through a survey of 1200 managers, data analysts (e.g., urban planners), and clerks in 42 municipal governments [30]. Most respondents used computer-based reports and attributed job enlarging influences to computer use. Respondents also attributed increases in job pressure, but not closeness of supervision,

to computing. These effects increased with the centrality of computing in their work Computer use had perceptible, but not dominant effects on the jobs of many people who used the technology Overall, his respondents reported that computer use enlarged their jobs, but did not profoundly alter the character of their jobs.

Computing was viewed as a salient technology by managers, data analysts, and clerks who utilize it regularly. For some, computing substantially increased the ease with which they can obtain valued information and made possible more complex data analysis. For others, it has had little utility White collar workers in several different occupational specialties attributed clear, often positive influences to computing in their jobs. Computing use also moderately increased the level of task significance and job pressure in the work of computer users.

Kling's findings [30] support those of Whisler [87] who indicates that managers are better served by computing than are clerks. But even traffic clerks in his study generally attribute job enlarging influences to computing. His data lend no support to analysts who argue that the dominant effect of white collar computer use is to diminish the quality of working life. On the contrary it supports claims that computer use often enlarges the jobs of workers who use the technology And the computer-based information systems he studied do not appear to be used to increase

closeness of supervision. The detailed patterns and levels of impact vary from one occupational specialty to another and can best be understood in terms of different work contingencies and information system designs. In addition, the technology is not always easily implemented -- difficulties in getting data, dealing with computer specialists, the computing services organization, and the technolgy itself all add minor and continual turmoil to the workplace. But overall, the technology does not dramatically change the character of work. Rather, it has a benign, and minor influence on the work of these computer users.

These findings differ from those reported by scholars such as Whisler [87] and Hoos [16] and they open up new avenues of research. Computing and increased supervision do not necessarily go hand in hand, but little is known about the conditions under which computer-based systems are used to increase supervisory control. Kling examined the impacts of computing on the job characteristics of data analysts. As computer use becomes more widespread, and is used routinely as an instrument in many occupational specialties, the utility of studies of managers and clerks for extrapolation to other occupational groups will diminish. Lastly, studies of the role of computing in the workplace have been remarkably atheoretical. Good theory building can benefit from descriptive studies of high quality But it is not too early to begin developing theories of the role of

computing in a broad array of work settings.

3.2 Social And Public Policy Issues Of Computing

No one topic has been so throughly associated with computing in the public imagination as has "privacy" of personal information. But there are many other public policy issues that touch on computing developments [47], including the development of electronic funds transfer systems [26], mandated practices to diminish the likelihood of computer-oriented crimes [17, 57], and the conditions which render computing development accountable to broad publics in addition to their developers [28]. This section examines some of the recent research conducted under the rubrics of privacy and social accountability

3.2.1 Privacy Studies -

During the 60's analyses linking computing and personal privacy were largely speculative. Nevertheless, there was a common set of beliefs about the influence of computer use on organizational recordkeeping systems:

1. Organizations using automated record-keeping systems would collect more personally sensitive data about individuals;

2. Organizations using automated record-keeping systems could more easily share data about selected individuals with each other;

3. The joint effects of more organizations collecting more data and sharing it casually would lead to serious losses of individual privacy

During the early 70's, two empirical studies of the record-keeeping practices of large computer-using organizations were published which broke major ground in shedding light on the preceding claims [63 86]. The differences between them are also instructive.

Westin and Baker studied 55 organizations and emphasized accounts of their record-keeping practices provided by key officials. Their report [86] includes detailed accounts of 14 organizations including police agencies, a large bank a state motor vehicle registry, an insurance firm, and a credit reporting firm (TRW Creditdata). Rule studied fewer organizations, which included police agencies, insurance providers, state motor vehicle agencies, and credit providing and reporting firms (also including TRW Creditdata). Both studies focus upon

the role of automation in record-keeping practices. Both contrast the practices of automated systems with their manual precursors, and attempt to attribute changes in practices to changes in legislative demands, organizational practices, business arrangements, social conventions, and technical feasibility Both studies conclude that technical feasibility plays a small role in shaping the kinds of records collected and shared by computer-using organizations. In addition, they find major institutional barriers that prevent organizations from routinely pooling information about their data subjects.

Yet the major policy conclusions of the two studies differ considerably Westin and Baker focus upon the data-subject's rights in dealing with modern organizations vis-a-vis the services they receive and the due process accorded them in insuring fair and equitable treatment regarding official records. Their major empirical conclusions are that modern organizations do not compose substantially more complex records about their clients than was done prior to the advent of computing. They recommend that the public has little to worry about as long as record-keeping systems allow data subjects due process in insuring the accuracy of their records, and they can retain a modicum of control over the records' use. Their policy recommendations emphasize the features of 'hygienically acceptable" systems rather than posing limits on the kinds of record keeping systems that should or should not be

built.

Rule's study focuses upon the development of systems for mass surveillance and social control in advanced industrial societies. In these societies organizations are the agencies of surveillance, and formal record keeping systems serve as a critical instrument. These differences in concern between Rule and Westin and Baker are central to the terms of their analysis. Each uses the the organizations studied to typify practices within its institutional sector. But Rule is much more careful than Westin and Baker to make institutional sectors a unit of analysis. Thus Rule's account of TRW Creditdata is embedded within an extensive account of the American credit reporting industry while Westin and Baker focus primarily upon TRW Creditdata. Rule is less interested in the fairness with which individuals are treated when dealing with organizations than he is with the devlopment of modern organizations of large scale which must rely upon formal record systems to make fine grained decisions about the treatment of their clients and data subjects. Westin and Baker applaud the TRW Creditdata's practice of collecting only objective data" about a person (e.g., account 60 days overdue") rather than "subjective data" (e.g., slowpayer"). For Rule these differences between TRW Credit Data and the other firms are less important than is the fact that TRW is highly centralized, keeps records about some 20 million individuals, operates in eight metropolitan regions rather

than just one, and that it provides extensive credit histories rather than recent summaries. Furthermore, he notes that credit reporting firms must provide some derogatory information to help credit grantors select the most creditworthy clients. For Westin and Baker, these developments are not problematic. For them, administrative procedures that insure fairness and equity dominate. For Rule, the texture of social relations in a society are as central as fairness and equity. While he never makes explict reference to Goffman s "total institutions" (e.g., organizations such as prisons, mental hospitals, and the miltary which control the major activities and temporal order of a person's life), Rule is concerned that modern organizations of large scale can become more like total institutions. Both Rule and Westin and Baker concur that contemporary record keeping systems are not widely abused and that the relationship between automation and abuse is problematic in practice.

Rule differs from Westin and Baker in his assessment of the social meanings of automated record systems. He defines the "surveillance capacity" of an information system by the sheer amount of meaningful personal data available on those with whom the system must deal.... the effective centralization of data resources...., the speed of information flow and decision-making within the system...., and the points of contact between system and clientele [86:269-277]." And he argues that as modern organizations

develop on a larger scale, they increasingly rely upon (automated) information systems of larger surveillance capacity to carry out their business. Traditional analysts view increasing surveillance capacity as troublesome because it may invite political abuse [42, 86]. For traditional analysts, legal procedures [86] or technical fixes [42], something like childproof lids on aspirin bottles, should suffice to render systematic and large scale abuses of personal data unlikely When it is properly protected, the public should focus on the increased array of services provided by automating organizations rather than the surveillance capacity they extend.

Both Rule and Westin and Baker take great pains to analyze the extent to which abuses of personal information occur in current systems. Differences in their findings also parallel differences in their concerns about surveillance capacity. Both find that few abuses have occured in the past decade. Westin and Baker, for example, found a few episodes of abuse of the National Criminal Information Center's (NCIC) files. All of these were rapidly remedied. They also analyze accounts of surveillance through airline reservation systems that appeared in the popular press and argue that they cannot have happened as reported. They view the few actual abuses, such as selling criminal histories to prospective employers or clerks in a credit verification firm altering their credit histories, as essentially random acts of a few

individuals. Strong organizational procedures carefully enforced are sufficient protection. After all, one can steal or alter paper records as well as automated records. In contrast, Rule focuses upon the institutionalized practices which make it difficult for the public to understand how organizations handle information about them. "Privacy" of organizational practices, as well as individual records is, for him, a dominant feature of modern organizations.

> "Every mass surveillance agency which I have encountered insists that its files are 'confidential,' that its personal data are held 'in confidence.' All this means is that the information is used for some purposes and not for others, for in fact agencies vary widely in disclosure policies. Consumer credit reporting agencies in the United States are committed to the principal of confidentiality for example. But their reports are available to any agency or individual who appears to be a grantor of credit. Likewise, information held in criminal record files by the British police is 'confidential' in that it is not freely available to everyone. But... police data are supplied routinely to many employers and professional bodies, as well as accidentally or unofficially to other users. On the other hand the case studies have also noted instances in which the organizations maintaining filed information manage to protect it

quite effectively from outside access.

The organizations he studied varied in their openness about their record-keeping and -using practices. Credit grantors were reluctant to indicate how rarely they actually prosecuted individuals who did not pay their bills. The British police (Home Office) misled him about the extent to which they routinely shared data with other agencies, and its top officials were upset when he learned about and published their actual practices [63:78-84].

More seriously Rule is concerned that increases in "fine grained decision-making about individuals has become more common with the growth of large scale institutions, is facilitated by (automated) mass surveillance systems, does enable these organizations to act more efficiently and effectively on their own terms, and profoundly compromises the autonomy of individuals to conduct private lives which allow meaningful choices in discretionary personal behavior. These concerns are more difficult to transform into policy than are Westin and Baker's proposals for hygienic reform of record-keeping systems. For Rule suggests that organizations can be acting quite properly in their own terms, can be appearing to act with profound legitimacy, and yet can foster modes of social life that profoundly constrain the public. For example, "just discrimination" would lead employers to prefer employees who were thoroughly upright in their dealings with others. There is no clear

principle which sets definite limits to the kinds of information employers should be able to collect to help sensibly select among prospective employees. While one would not wish people convicted of perjury to be placed in positions of fiscal trust, one might want to set limits about the length of time information about one s criminal past might be easily accessible. In principle, an employer might be able more easily to select suitable staff if he knew about each applicant s veracity in dealing with every person whom he has ever known Such information is not easy to collect, and Rule is concerned that only economic costs serve as a barrier to collecting and using similarly delicate information.

In section 3.1.3 I suggested that the better studies were more empirically grounded than those of lesser quality. But empirical integrity is not the only important criterion for distinguishing studies of computing in social life. The primary difference between Rule's study and Westin and Baker's is not empirical orientation, but their sympathies to the emerging social order of advanced industrial societies. Westin and Baker remain remote from the major social questions of this period about how societies should be organized, and simply wish to see that the social game is conducted fairly Rule raises much more serious questions about the dominance of large scale organizations which may induce delicate forms of social control to engage in effective business. These differing questions and

sentimental orientations influence the data each researcher sought and the sense he made of it. The contrasts between Rule's study and Westin and Baker's clearly illustrate the role of ideology in shaping a study of computing in American institutional life. But all studies of computing in social life are based upon implicit ideological orientations which help focus attention and interpret data collected in answering them. It is vain to hope that studies of computing (or technology) in social life can be value free. The best scholars make their value commitments explicit so that readers can appreciate and compensate for their biases [63:350]. Often, value orientations are implicit, but transparent. However, those analysts who claim their analyses to be thoroughly value free should be most suspect of obscuring their own commitments.

3.2.2 Social Accountability Of Computing -

Many computer-based systems are well designed and services based upon them serve their direct users relatively well. Physicists can usually solve complex equations and travellers can change their airline reservations in the middle of a trip with little thought about the reliabity of the computer, its operating system, applications software, or the organizational units which operate it. On some occasions computer use is troublesome. Accountants in the

operating divisions of a large firm may find a centralized budgeting system provides them with no new information, but is coupled with organizational procedures which add burdensome data entry and deadlines. Computer-using chemists in a university laboratory may find that the campus computer center alters software and procedures without informing them of impending changes, despite predictable disruption. Individuals who receive inaccurate bills from a firm using automated accounting may find it difficult to detect and correct errors [74, 76]. Individual cases in which computer-based services are organized so that they routinely provide better or poorer services to their clientele illustrate the meaning of "social accountability." "Social accountability" denotes ways of organizing computer specialists, organized groups that develop, manufacture, sell or use computer-based systems, and their markets, so that the broader public is well served. The critical question is how computing arrangements should be organized to maximize social accountability. Answers differ. Some analysts propose that market-like arrangements be relied upon while others argue for the regulation of computing markets, technical standards, and programmer skills.

In a recent study Kling examined six kinds of policy models which are often relied upon to insure that new computing arrangements are accountable to broad publics [28]:

1. Competitive market arrangements
2. Administrative authority
3. Professional control
4. Regulatory commissions to administer legislative acts
5. Judicial enforcement and review of of legislative acts
6. Citizen action

Each of these models is appropriate for dealing with different kinds of computing arrangements. For example, a firm seeking remote computer services in a large metropolitan area may find competitive market arrangements satisfactory to help find suitable services. Similarly, a citizen seeking information about his credit records may find that the Fair Credit Reporting Act, and its tacit enforcement through judicial review may provide sufficient means at least to learn about his official records. Similarly each of the six models is best applied to certain practical situations and social contexts where computer-based services are provided. Collectively they span the set of policy instruments available in liberal democracies. While these models have been extensively developed and examined in a variety of settings, their appropriateness for computing is usually tacitly assumed, rather than grounded in careful analyses. Kling analyzed the assumptions of each model and found that they have severe problems in either their practical effectiveness or their appropriateness for computing.

Kling's analyses depends heavily upon studies of public choice and administrative activity undertaken in a wide variety of settings. Much of the skepticism in his analysis about the sufficiency of the available models is based on these studies. This skepticism is also congruent with the theoretical and practical difficulties attendent in providing sharp guidance for effective and responsive institutions, public and private. During the last decades we have had extensive experience with large scale technology developments such as automobiles, telephones, television, air travel, and credit cards which have slowly been woven into the fabric of American social life. As major social institutions have shaped their activities to exploit these technologies, we have learned that large scale arrangements can be difficult to manage efficaciously Faith in an objective public interest has also been eroded both through compelling pluralist analysis of American institutions and through sharp theoretical analyses (e.g., Arrow s impossibility theorem) which frustrate the search for objective decision criteria for complex public choices.

In addition, the peculiar nature of computing makes the assumptions of the traditional models for accountability difficult to satisfy

1. Computing is often viewed as a "tool," but computer-based services often entail many specialized groups to develop and maintain the service. Under such conditions, computing is more accurately viewed as a "package" which includes many complex social elements as well as technical elements [33]. The complexity of the computing package leads computer users to have imperfect information about the services they can receive, and it makes their transaction costs in altering their services or substituting unautomated alternatives difficult. The package aspect of computing renders the model of perfect market competition inapproriate for regulating the quality of computer-based services provided to many publics.

2. Computer-based services are also buffered from direct public contact and decision in several different ways. Most computer-based products are developed in a complex cascade of markets in which they are progressively custom-tailored to the setting of use [32].

3. The development and administration of information systems is usually carried out at the lower levels of large organizations, and its details are often remote from top-level scrutiny

4. Both the benefits and problems of computer-based services are relatively intangible. Unlike smog, they are invisible. Computer-based systems rarely have the dramatic life-giving consequencies of appendectomies or the brutal costs of industrial explosions. Alteration in the conveniences faced by consumers or in the relations between the public and major institutions may affect the felt quality of life, but are difficult to document, and value [24, 26].

In combination, these characteristics make large-scale computing arrangements more problematic than the boons and travails of other large scale technologies.

4.0 ON "THE COMPUTING REVOLUTION"

Several years ago it was fashionable to refer to an imminent "computing revolution. While computer-based systems have become commonplace in medium and large organizations and in public places through a spread of point of sale terminals, talk of revolution" has diminished. Often the impacts of computing are very diffuse and subtle. Decisions made by public officials are rarely influenced by computer-based systems. but occasionally automated data has a potent effect. Studies of computing in the workplace that measure not only the impacts of computing, but also their

relative importance also indicate that computing is noticeable, but subtle in its influences [30]. Computer terminals are becoming more visible and widespread but a "computer revolution" is still more of a publicist s phrase than a shrewd observation

The current situation with computing is similar to that of automobiles in 1903. The benefits to a few individuals seeking flexible transportation or social status were easily visible. Larger scale effects were more difficult to discern. In 1903 in Los Angeles there were few cars. When there were few cars it was very difficult to predict what impacts the automobile would have simply by studying the uses to which automobiles were put or to study the major forms of social organization. The first time Los Angeles had smog was in 1940, 40 years after the automobile was developed in the United States. A new form of metropolitan organization in which the urban core was dwarfed by bedroom suburbs developed on a large scale well after World War II. The movement of families across country so that many people could live and work hundreds of miles from where they were born and raised has been continuing during the last three decades. If one had wanted to think ahead about what benefits cars would have, what social dilemmas certain styles of social organization around cars could produce, one would have had to be unusually prescient in 1903. There simply weren't enough cars and a social system sufficiently saturated with them to see the real major effects. But an

analyst who thought that automobiles were simply fun to drive, but portended nothing larger regardless of the scale on which they were to be used, would have been mistaken. By the time that major effects could be visible often major investments were made that would be difficult to alter, even when troubles were clear By the time the smog had become so intense that the mountains surrounding Los Angeles were invisible most days, people had already become dependent not just on the car, but on forms of social life built around cars -- nuclear families dwelling in suburban tracts without buses and living 10-30 miles from work friends, shopping, and other posts of daily life. It is almost impossible to reverse these social elements in which the automobile is a central element.

There's no simple way to measure a "revolution." Saying that the average American family owns 1.8 cars does little to indicate how community life in the U.S. today differs from community life 100 years ago. Similarly counting computers, computing expenditures, computing users, or other easily countable items only suggests a measure of social activity. Such numbers indicate little by themselves.

The social changes that can be attributed to computing are minor when compared with other dynamic elements of American social life: shifting life styles from cities to suburbs (and back again), women entering the workforce in large numbers, the increasing fragmentation of families, the

spread of two-career families, and an aging population which is increasingly dependent upon energy intensive technologies. In addition, capital and labor have become increasingly concentrated in several hundred large organizations and public life is becoming more privatized [69]. Not only are the effects of computing subtle but they are easily overshadowed by other ongoing social dynamics that cross-cut evaluations of their influence.

Many social observers and computer scientists have been fascinated by the potential potency of computing to profoundly alter social life. Technologies like computing don't "impact" life like "ships colliding at sea" [53], but rather are subtly woven into ongoing social patterns. One hopes that important technologies, such as computing, can be sufficiently well understood by many social groups early on, so that important decisions about whether, when, and how to utilize computer-based systems will be more socially benign than would otherwise be the case.

These observations have serious consequences for research designs. First, studies of computing are best conducted in settings where the technology

is pervasive*. The pervasiveness of computing in large modern organizations makes them an especially attractive "laboratory" for learning about the roles of computing in social life. Second, analysts need to closely observe patterns of computer use and the sense that people make of computing in their lives. This argues for case studies, and other qualitative field studies in which surveys serve primarily as a supplemental source of data. Third, it means that analysts must be especially careful in extrapolating their results across social settings and time.

* Inferring influences of computing in settings where its use is weak is difficult at best and often misleading. Simon, for example, uses survey data from national surveys of job statisfaction to evaluate the influences of computing on worklife [73]. His attempt is laudable, given the paucity of data about computer use and its influences. But it is misleading. So few workers have had extended contact with computing that one should not expect surveys of workers sampled randomly from the U.S. population to show much, even if computing were extremely potent in the places where it is used. Even careful studies of computer use in relatively highly automated work settings show that its influences are subtle [30]. Simon s use of national survey data opens important questions about the conditions under which one expects the influences of computing to be noticeable, how much they may be masked and coupled with the influences of other ongoing social patterns, over what time period one expects the influences of computing to become visible, etc. To raise these questions is not to answer them. Better analyses implictly contrast the influences of computing on social life with other ongoing dynamics having similar or conflicting effects [39, 63]. But it is easy for even sensitive analysts to confound the influences of computer use with other social patterns when they do not carefully account for them [83].

5.0 CONCLUSIONS

This paper has surveyed some of the major North American studies of social issues raised by computing and the role of computer-based technologies in social life. It may provoke many new questions which are unanswered here. As we have seen, the questions asked often depend upon the values and interests of the investigator. In this period, almost every significant study of computing in social life raises new questions in answering old ones. Studies differ substantially in the significance and scope of the questions they address.

This review of topics and studies has necessarily been selective. It has been influenced by my own interests in understanding the interplay between computer technology and the social character of settings in which it is used. These interests have lead me to select some topics (e.g., decision-making in organizations) where there are sufficiently careful studies to illustrate those interactions. In addition, I am more trusting of studies which are sensitive to the conflicts over values amd interests which are often found in social groups. I believe that studies which treat the level of conflict and consensus over values and interests in a social setting as empirically open are the most credible. And I have selected studies which illustrate how computer technologies are influenced by and influence the distributions of value, authority and

power in settings of use.

Most serious studies of computing in social life are prospective and aim to improve the lot of those who control computing resources, those who use them, or those whose lives may be profoundly affected by their use. The utilization and utility of much research is often problematic [85]. Studies conducted in this arena suffer the same fate as studies on other timely topics. They catch the attention of computer specialists, managers, policymakers, and other interested parties rather haphazardly Some of the best studies are too careful and "stuffy" to appeal to large audiences. Some studies capture attention and crystallize emerging policies because they are well written and timely Westin and Baker's study has influenced much of the federal policymaking community's views of information privacy [86]. Kraemer's studies of software transfer have also been influential in policymaking within HUD [36]. Weizenbaum's insightful, but polemic and uneven, analysis of computing has spurred debates among computer scientists about the social character of computing and the theoretical and social limits of artificial intelligence [83]. Similarly other analysts and their studies have attracted attention in specialized communities.

It is possible to draw optimistic, sanguine, and pessimistic conclusions from these research streams. During the 70's, I believe that we have learned to understand the

social dynamics of computing far more carefully. The ways in which the uses and influences of computing are altered by the social settings in which the technology is adopted are becoming well documented. These increases in analytical sophistication provide a basis for scholarly optimism.

However, there are still no adequate theoretical accounts of computing in social life. But it is also fair to say that there are few candidate theoretical accounts of the role of technology in social life. The accounts of computing which are developed by scholars or by laymen are strongly limited by the primitive state of social theory generally and by the common myths which surround complex technologies in particular One may easily be sanguine that accounts of computing in social life may grow in sophistication along with advances in social theory and research method generally In addition, there are also good reasons to believe that studies of computing may help develop certain niches of social theory

However, as one turns from the content of these studies to the broader social context which they address, the grounds for optimism grow thinner. Computer use is rapidly expanding in the United States. It is hard to believe that the public could be best served by rapid development of a poorly understood technology In characteristic American fashion, a good deal of attention is spent in developing "knowhow" of computing technologies and their applications.

As a consequence, technical improvement in the quality of equipment and the richness of applications software has grown immensely However only a dozen scholars seriously investigate social aspects of computer use. Their studies have influenced some aspects of public policy related to computing development, particularly policies regarding privacy of personal information. But the pace and scope of new computing developments far outstrip our capability to carefully understand their near and long term social repercussions. With such meager systematic attention, it is hard to believe that important understandings about the long term and more subtle social features of computing will be understood before inappropriate commitments are made*.

* Understandings of the social nature of computing are commonplace, partial, localized and unsystematic. In each organization, some staff have developed keen intuitions about the role of computer-based systems in altering some aspect of organizational procedures, worklife, or relations with clients. However, these perceptions are rarely systematized and accessible to other participants so that they may sensibly inform decisions about whom and how to automate. Moreover, little information passes from organization to organization about the details of computing use, particularly problems. Consultants and mobile employees pass some information, but such exchanges are also fragmented. See [25] and [38] for systematic evaluations of computing projects which were highly publicized as success, but which upon careful analysis failed to achieve their espoused goals. Studies such as these provide insights into the dynamics of computer use which are usually unavailable to people who did not participate in the original events. And there is a systematic bias against making such understandings widely available.

Table 1

Sample Substantive Topics with Illustrative Citations

I. Impacts of Computing in Organizations

1. Innovation [8, 25, 32, 36, 59]
2. Implementation [19, 22, 43]
3. Workplace [4 16, 30, 44 87].
4. Decision-making [6, 7, 13 21, 23 25, 27, 39, 73 66].
5. Organizational structure [3 87].
6. Interactions between the public and computer-using organizations [74, 76].

II. Social and Public Policy Issues in Computing

1 Privacy [14, 26, 61, 63 65, 84, 86].
2. Social accountability [28, 41].
3. Computer crime [17, 57].

III. The Computing World as a Social Institution [31, 32]

IV. Ethical Dilemmas of Computing [58, 83].

Table 2

Studies of Computing with Technology-based foci

1. Electronic Funds Transfer Systems [24, 26, 37].
2. Organizational Information Systems [9,10,19,23 25, 35,41,87]
3. Artificial Intelligence [83].
4. Computer-assisted Instruction [56].
5. Databanks and Information Utilities [61, 66, 84, 86].
6. Computer Conferencing [15]
7. Simulation and Modelling [13].
8. Network Information Services [15, 42, 46].
9. Personal Computing [8]

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