Understanding and Communicating SOCIAL INFORMATICS

A Framework for Studying and Teaching the Human Contexts of Information and Communication Technologies

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1.2 Defining Social Informatics

Since the deployment of the first commercial digital computers in the 1950s, their potential power to extend human and organizational capabilities has excited the imaginations of many people. Their potential has also evoked fears that use would lead to massive social problems, such as widespread unemployment. In the 1950s and 1960s, digital computers were relatively expensive (often costing hundreds of thousands of dollars) and relatively few were in use. Consequently, it was difficult to observe their effects, and the writing about computerization was primarily speculative. For example, the concerns about computerized systems becoming efficient substitutes for human labor led to speculation about mass unemployment, radically reduced work weeks, and the "problem" of how millions of people would be able to manage huge amounts of leisure time. From today's perspective, in which computer systems have become ubiquitous and professional work-weeks seem to have expanded, these speculations may seem quaint.

In the late 1960s and early 1970s, some social scientists began empirical observational studies of the consequences of computerization inside organizations. During the 1970s and 1980s, this body of research expanded to cover topics such as the relationship between computerization and changes in the ways in which work was organized, organizations were structured, distributions of power were altered, and so on. Most of the empirical social research was conducted within organizations because they were where the computers and the people who used them most intensively were located. We will discuss the findings of some of these studies in other chapters of this book. Even though these studies may seem to be dated and of limited relevance in the era of the Internet, they can help us understand some key aspects of contemporary issues. Here, it is sufficient to say that some important studies contradicted the prevailing expectations about the effects of computerization that were seen in the books and articles written for ICT specialists, managers, and the broader public.

By the 1980s, research about the social aspects of ICTs was conducted by academics in a number of different fields, including information systems, information science, computer science, sociology, political science, education, and communications. These researchers used a number of different labels for their specialty area, including "social analysis of computing," "social impacts of computing," "information systems research," and "behavioral information systems research." For over thirty years, these research studies were published in the journals of the diverse disciplines, and were written in the researchers' distinctive disciplinary languages. As a consequence, it was hard for many researchers, let alone nonspecialists, ICT professionals, and ICT policy-analysts, to easily track relevant research.

In 1996, some participants in this research community agreed that the scattering of related research in a wide array of journals and the use of different nomenclatures was impeding both the research and the abilities of "research consumers" to find important work. They decided that a common name for the field would be helpful. After significant deliberation, they selected "Social Informatics." (In Europe, the name informatics is widely used to refer to the disciplines that study ICTs, especially those of computer science, information systems, and information science.) Some members of this group held a workshop at Indiana University in 1997, and agreed upon a working definition: *Social Informatics refers to the interdisciplinary study of the design, uses, and consequences of ICTs that takes into account their interaction with institutional and cultural contexts*. Social Informatics analyses that are bounded within organizations, in which the primary participants are located within a few specific organizations, are referred to as organizational informatics. Many studies of the roles of computerization in shaping work and organizational structures fit within organizational informatics.

This definition of Social Informatics helps to emphasize a central principle: ICTs do not exist in social or technological isolation. Their "cultural and institutional contexts" influence the ways in which they are developed, the kinds of workable configurations that are proposed, how they are implemented and used, and the range of consequences that occur for organizations and other social groupings.

Social Informatics is characterized by the problems being examined rather than by the theories or methods used in a research study. In this way, Social Informatics is similar to other fields that are defined by a problem area such as human–computer interaction, software engineering, urban studies, and gerontology. Social Informatics differs from fields such as operations research, where methodologies define their foci and boundaries. Social Informatics research is empirically focused and helps interpret the vexing issues people face when they work and live with systems in which advanced ICTs are important and increasingly pervasive components.

Social Informatics research comprises *normative, analytical,* and *critical orientations*, although these approaches may be combined in any specific study. The *normative orientation* refers to research whose aim is to recommend alternatives for professionals who design, implement, use, or make policy about ICTs. Normative research has an explicit goal of influencing practice by providing empirical evidence illustrating the varied outcomes that occur as people work with ICTs in a wide range of organizational and social contexts. For example, some early research (e.g., Lucas, 1975) showed that information systems were much more effectively utilized when the people who worked with them routinely had some voice in their design. One approach, called participatory design, was built on this insight, and

researchers tried to find different ways that users could more effectively influence the designs of systems that they used. Further, some of these studies found that it was important to change work practices and system designs together, rather than to adapt work practices to ICTs that were imposed in workplaces. The recommendations from this body of research are rather direct: ICT specialists and managers should not impose ICTs on workers without involving them in shaping the new ICTs and the redesign of their work practices. These recommendations differ substantially from the strategies of some business reforms of the early 1990s, such as Business Process Reengineering (BPR), whose advocates preferred that ICTs and work be designed by people who were not invested in the workplaces that were being changed. Social Informatics researchers blame some of the failures of BPR on an ideology that undervalues workers' knowledge about their work.

The *analytical orientation* refers to studies that develop theories about ICTs in institutional and cultural contexts, or to empirical studies that are organized to contribute to such theorizing. Analytical research develops concepts and theories to help generalize from an understanding of ICT use in a few particular settings to other ICTs and their uses in other settings. For example, one line of analysis examines specific ICTs as embedded in a larger web of social and technical relationships that extend outside the immediate workplace (or social setting) where the ICTs are used (Kling, 1993; Kling & Scacchi, 1982). This line of analysis indicates that complex ICTs may be workable where technical support is available "in the environment." Thus, public schools in university towns may be able to use more complex ICTs when technically skilled undergraduates provide technical support through part-time jobs or independent study courses. The same ICTs may prove unworkable for public schools in cities where inexpensive technical talent is unavailable. The analytical approach, in this case, examines the way that the social milieu is organized to provide resources for training, consulting, and maintaining ICTs, rather than simply the technical simplicity/complexity of the ICT in social isolation.

The *critical orientation* refers to examining ICTs from perspectives that do not automatically and uncritically accept the goals and beliefs of the groups that commission, design, or implement specific ICTs. The critical orientation is possibly the most novel (Agre & Schuler, 1997; Schultze & Leidner, 2002). It encourages information professionals and researchers to examine ICTs from multiple perspectives (such as those of the various people who use them in different contexts, as well as those of the people who pay for, design, implement, or maintain them) and to examine possible failure modes and service losses, as well as ideal or routine ICT operations.

The critical orientation is exemplified by the case of some lawyers who wanted to develop expert systems that would completely automate the task

of coding documents used as evidence in civil litigation. Social Informatician Lucy Suchman (1996) examined the work of clerks who carried out this coding work and learned that it often required much more complex judgments than could be made by rule-based expert systems. She recommended that information systems be designed to help the clerks with their work rather than to replace them.

Ina Wagner (1993) examined the design of a surgical room scheduling system and found that major stakeholders (surgeons, nurses, and patients) had somewhat conflicting preferences. If a system were to be designed, the designer would have to take sides in a set of workplace disputes. Ann Rudinow Saetnan (1991) found that an automated surgical room scheduling system was being used only as a record keeping system because of conflicts between surgeons and nurses about when to make exceptions to the automated schedule. These studies indicate that a systems designer who tries to develop "a better automated scheduling system" may have trouble in designing for only one group, such as surgeons.

An important set of instances arises in the analysis of the safety and effectiveness of systems for people and the operations of organizations. For analysts who conduct post-mortems on ICTs that have failed, it is common to find that the designs or implementations of these systems were not critically examined for the variety of conditions under which people might use them or the ways that they could interact with other limitations in the technical or social systems in which they were embedded (Kling, 1996c; Neumann, 1995; see also Chapter 2, Section 2.1 for further discussion and examples). The findings of Social Informatics research would lead an informed analyst to frame the discussion of a new or changing ICT within a detailed depiction of the organizationally-situated social conditions of likely use.

1.3 The Value of Social Informatics

The empirical base of Social Informatics research provides valuable insights into the contemporary issues with computerization. Some examples that we will discuss later in this book include:

- How can we best understand the meaning of "access to the Internet" in ways that help to foster policies to reduce the "Digital Divide"?
- When does the reliance on weapons systems that use advanced ICTs risk escalating a war rather than reducing conflict?

- How can organizations effectively use computer networks to help their professionals share important information about expensive projects?
- To what extent and when have ICT developments fostered "paperless offices"?
- When can ICTs in K–12 classrooms replace traditional media, such as textbooks, and when are such substitutions likely to be costly and pedagogically troublesome?

One reason why many predictions about the social effects of specific ICT consequences have been so inaccurate is that they are based on oversimplified conceptual models of specific kinds of ICTs or of the nature of the relationship between technology and social change. For example, a simple and common way to view the role of ICTs is as a set of discrete tools. In this view, the computer is a machine that can help rapidly produce a thick book in a few minutes or rapidly solve a complex differential equation. ICT applications like these, wondrous as they are, take on an added transformative dimension when they are networked with other information technologies, such as those that enable people to use the World Wide Web to get up-to-date weather reports or make it easier for a team of scientists to work together even when they are located in different time zones. Further, assumptions about these relationships and models are often tacit, making them even more powerful because they are taken for granted. For example, many armchair analyses of computerization assume that:

- ICTs have direct effects upon organizations and social life.
- These effects depend primarily upon the ICTs' information processing features.
- The information processing features of new ICTs are so powerful relative to preexisting technologies that they effectively determine how people will use them and with what consequences.

For example, the U.S. national effort to "wire" K–12 public schools to connect to the Internet reflects a belief that students' access to the Internet will improve their educations. The motivation behind this reasoning is laudable. An analysis that pushes beyond the face value of this belief leads to questions about how this wiring will actually be done and what changes in the educational process will lead to improved learning. For example, many primary and secondary teachers do not know how to use Internet resources to extend their class activities (and will require both training to get prepared and ongoing support to maintain competence). Further, most schools' computers are

in special labs, so that the computing is not integrated into routine classroom practices. Instead, and by design, the computing is often isolated from the curriculum. Thus, the potential value arising from the technical triumph of wiring the school is overshadowed by the need for changes in teacher training and support and to the large-scale curricular (and floor plan) design in order to incorporate computing. And, even after these changes, the issue of exactly how Internet use improves learning has not been addressed. (We examine this topic in more detail in Chapter 3.)

The body of empirical research in Social Informatics does not make these tacit assumptions about the roles and uses of ICTs. In fact, this research has shown that many forms of ICTs, such as groupware, instructional computing, and manufacturing control systems, are often abandoned or reshaped to be used in new ways. In addition, many ICTs create problems that their designers and advocates did not effectively anticipate.

Further, the Social Informatics research literature shows that the consequences of ICT use can appear "contradictory" because they can differ across the various situations in which the ICTs are deployed. Some "distance education" courses taught over the Internet are found to be distressing to their student participants, whereas others develop more positive learning environments (Hara & Kling, 2002). Sometimes computerization leads to organizational decentralization and at other times to centralization of control. Sometimes computerization enhances the quality of jobs and other times jobs are degraded through tightened controls and work speedup.

This book identifies some of the ideas that have come from over thirty years of Social Informatics research—systematic and empirically grounded research about the design, development, uses, and effects of ICTs in social life. Because these findings draw from multiple disciplines and are couched in the specific and particular scientific languages of these disciplines, relatively few of these ideas have been disseminated effectively and, consequently, have not shaped the working practice of most information professionals. Further, much of the body of Social Informatics knowledge has not yet been integrated into many curricula to help better educate young ICT-oriented professionals, and has yet to influence research in related areas, such as digital libraries and new forms of organizing.

As we introduce you to Social Informatics research, we hope to provide you with a useful point of entry into this research world. In the chapters that follow, we discuss the meaning of the concept of Social Informatics and the theories, approaches, and findings that characterize Social Informatics research. We also explain how Social Informatics can be integrated into the curricula of programs and courses focusing on ICTs and social and organizational change.

Endnote

1. The acronym "ICT" refers to information and communication technology—artifacts and practices for recording, organizing, storing, manipulating, and communicating information. Today, many people's attention is focused on new ICTs, such as those developed with computer and telecommunication equipment. But ICTs include a wider array of artifacts, such as telephones, faxes, photocopiers, movies, books, and journal articles. They also include practices such as software testing methods, and approaches to cataloging and indexing documents in a library.

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CHAPTER 2

The Consequences of ICTs for Organizations and Social Life

Scholars, information professionals, policy analysts, and the public are each, in their own ways, working to understand the consequences of ICTs on their lives, institutions, and social life. For example, the educational and social consequences of school leaders enabling their students to use the Internet is a topic of discussion among politicians, educators, and parents, as well as researchers. In contrast, topics such as whether enterprise integration systems will enable organizations to streamline their operations or will become costly forms of "electronic bureaucracies," are of more specialized interest, mostly to information professionals and managers in large firms and to researchers. Whether the forms of computerization are those that most directly concern specialized professionals or are of broader public interest, the consequences of computerization are a pervasive concern for society.

Understanding the organizational and social consequences of having, using, and developing ICTs is increasingly important for contemporary professional practices and social policies. As we have noted in Chapter 1, researchers, professionals, consultants, journalists, and pundits have produced a large and growing body of writing about these topics. However, this writing is often difficult to access, much less to comprehend. Moreover, we consider the most reliable portion of these writings to be that which is produced by researchers who study these topics.

This body of literature is known as Social Informatics and in this chapter we begin outlining some of the common findings. To help frame this outline, we begin by discussing why direct effects theories of the consequences of computerization have not been very effective. Direct effects theories predict that computerization leads to some directly attributable outcome**.** One pervasive form of the direct effects model is technological determinism. Technological determinism treats ICTs as information processing systems whose technical characteristics *cause* specific social changes when they are adopted and used.

Although technological determinism can be applicable and useful in situations that are characterized by high degrees of control and short time frames, it has limited value in dynamic and complex situations that unfold over longer periods of time. Technological determinism cannot adequately account for the interactions among ICTs; the people who design, implement, and use them; and the social and organizational contexts in which the technologies and people are embedded.

There are alternatives to technological determinism and other direct effects theories. Typically these alternatives to direct effects approaches are socio-technical in nature (MacKenzie & Wajcman, 1999) and are often more complex. By socio-technical we mean that they attempt to conceptualize both social and technical aspects as interrelated (Mumford, 2000).

Socio-technical theories help to make clear that the relationships among the features of a particular technology (in our case ICTs) are intimately tied to the specific individual and institutional arrangements among people and their larger social milieu. For example, one of the simplest and most widely used forms of socio-technical analysis is systems rationalism (Kling, 1980). Systems rationalism is a perspective that conceptualizes ICTs as rule-bound and carefully structured and then generalizes these rule-based characteristics to people, groups, and organizations. From this perspective, organizations and the people who work in them constitute rational systems, with formal common goals and work practices carefully designed to meet these goals. These systems can be analyzed at varying levels of granularity in terms of the costs and benefits of alternative sets of goals and practices.

Systems rationalism is a useful starting point to help understand the value of ICTs in organizational practices, social activities, and work life, but it is not a good endpoint for such analyses. Like all analytical models, systems rationalism simplifies the nature of the ICTs, the nature of people and their relationships, and the ways in which people interact with technologies. Beyond simplification, systems rationalism is problematic in that it tends to emphasize formalities. For example, people's work is represented by their formally defined tasks, such as a journalist's work tasks being formally defined as conducting interviews and writing articles. This differs substantially from a worker's *actual* tasks, which, in the journalist's case, may include such things as borrowing from other news stories, spending much time figuring out whom to interview, updating PC software, or scavenging for a new printer cartridge in order to print out a story draft. The vast discrepancy between a formal listing of job tasks and how employees actually spend their time also includes the issue of how formal job descriptions overlook the amount of dependency that workers have on other people.

By focusing on formalities and on simplifications, systems rationalism theorists often depict as streamlined processes that are much more messy and complex. This means that systems rationalism may be useful primarily in cases where the ICTs are designed and implemented to resolve a narrow set of well-understood organizational problems and there are high levels of consensus about problems and solutions by the major participants. However, this is not all that different from direct effect theories.

One of the critical steps to a better understanding of the roles that ICTs play in organizational and social life is that use is tied in with the messy and

complex way in which people work and live. For example, Suchman (1987, 2002) shows that using ICTs demands extensive micro-coordination among people and machines and that this is often difficult to foretell. Woods and Patterson (2001) find in their study of high performance systems (like mission control and nuclear power plant operations) that the work is dependent on ICTs and that these systems often cannot meet the needs of the workers (or the task) when most needed. That is, under increased stress, the ICT demand more complex work-arounds, not less. Simply, socio-technical models of ICT use lead to a broader understanding of how computerization is engaged and what its effects are.

Although socio-technical models of ICT use often provide deeper analytic insight, they take longer to conduct and explain than do direct effects approaches to understanding ICT use. The additional time is driven in part by the need to spend time to understand the work practices, uses of ICTs, and the organizational and social structures in which these work practices and uses are embedded. The additional time and effort and the rigorous methods of collecting and analyzing the range of data gathered typically lead to this work entering the scholarly and public discourses after the punditry and armchair theorizing. Thus, much of the Social Informatics research appears to contradict common perceptions. A more careful depiction would be that these common perceptions of ICT use are often built on crude and misguided assumptions about both the ways in which people work and the outcomes of using ICTs.

This short review of direct effects and socio-technical models of ICTs helps to make clear a conflict between the practical importance of being able to make predictions about the consequences of using ICTs and the knowledge that predictions may be fairly unreliable. Much of the reliability and robustness of consequential predictions depends upon the following:

- The time frame (shorter term is often more reliable than longer term prediction)
- The units of analysis (it is easier to predict average behavior for many groups or people than it is to predict the behavior of specific individuals)
- The level of prediction (it is easier to make "rough cut" predictions about generalized organizational or social consequences of technological change than more fine-grained predictions)

An example, particular to the third point, is that it may be easier to assess whether a new electronic forum will improve the quality of discussion in a

professional association than to predict the number of association members who will participate routinely.

In the rest of this chapter, we present general findings drawn from Social Informatics literature (see Table 2.1). In the first section, we focus on the social aspects of the socio-technical nature of ICTs. In the second section, we focus on the technical aspects of the socio-technical relationship. In the third section of this chapter, we provide an institutional frame that provides context to support our socio-technical analyses.

Table 2.1 Social, Technical, and Institutional Nature of ICTs

Social Nature of ICTs
ICTs are interpreted and used in different ways by different people
ICTs enable and constrain social actions and social relationships
ICTs provide a means to alter existing control structures
ICTs can lead to negative consequences for some stakeholders
Technical Nature of ICTs
ICTs have both communicative and computational roles
ICTs have temporal and spatial consequences
ICTs rarely cause social transformations
ICTs are not magic bullets: they do not solve things by themselves
The Institutional Nature of ICTs
ICTs social and technical consequences are embedded in institutional contexts
ICTs often have important political consequences

2.1 The Social Nature of ICTs

In this section, we discuss three general findings from Social Informatics literature that highlight the social (and organizational) nature of ICTs.

2.1.1 ICTs Are Interpreted and Used in Different Ways by Different People

One of the simplest conceptions of an ICT (or a service provided via the use of an ICT), such as e-mail, a specific digital library, a project scheduling system, etc., is that it embodies the same meanings for all its users. However, Social Informatics researchers have found that people frequently interpret

and interact with ICTs in more complex and varied ways (see Kling, 1980, 1993; Newell, Scarbrough, Swan, & Hislop, 1998; Orlikowski, 1993).

A case study of Lotus Notes' use at a major consulting firm illustrates this idea.[1] This consulting firm, which we will call Alpha, bought specialized equipment and 10,000 copies of Lotus Notes for its staff in 1989.[2] Lotus Notes, a documentary support system, is superficially similar to an Internet-like system with bulletin boards, posting mechanisms, discussion groups, and electronic mail for organizations. Depending upon how Notes is used, it can act as an e-mail system, a discussion system, an electronic publishing system, and/or a set of digital libraries.

Alpha is an international consulting firm with tens of thousands of employees worldwide. Its director of Information and Technology believed that Lotus Notes was such a powerful technology that its usefulness would be self-evident, and that the main thing to do was to rapidly roll it out to the consulting staff and let them use it in order to find creative ways to share information. The director felt that Notes was such a valuable tool that people would not need to be shown illustrative business examples for its use, and that providing examples would be counterproductive as it might stunt employees' imaginations. He felt that the consultants should simply be given an opportunity to use it, and they would learn how to use it in creative ways.

The director of Information and Technology was concerned that his firm was employing thousands of "line consultants" in different offices all over North America who were working on similar problems, but rarely sharing their expertise. Sometimes a consulting team in Boston would be dealing with an issue very similar to one being handled by a consulting team in Toronto or San Francisco. The consultants had no easy way of sharing their solutions to the problems they were facing with consultants in other offices. The plan was that the firm's line consultants would use Notes to store what they knew, and then share it.

The first test of Notes was with the information technology staff. They tended to use Notes; they found it interesting and used it fairly aggressively for sharing information about their own projects. Alpha's tax consultants in Washington, D.C. were the second group that used Lotus Notes. The tax consultants disseminated tax advisories to Alpha offices around the country about shifting changes in tax legislation that might affect their clients. Alpha's tax consultants made substantial use of Lotus Notes to broadcast their tax advisories.

The line consultants were intended to be Lotus Notes' primary users. However, organizational informatics researchers found that the senior line consultants, who were partners in the firm, tended to be modest users, while the more numerous junior line consultants, called associates, were actually

minimal users. They often seemed uninterested in learning how to use Notes, readily gave up if they faced early frustrations with Notes, and as a group did not spend much time with it. Here we have a pattern of different groups within an organization having different practices in working with Notes. How can we explain such differences?

One explanation focuses on the incentive systems in the firm. A good place to start our analysis is with the associate consultants and the partners. Alpha—and many other large consulting firms in North America—reviews its consultants through a demanding promotion system. The associates receive an "up or out" performance review every two years. In the first few rounds at major firms, about half of the associates are fired at each review. In this "up or out" system, the goal of many of the associate consultants is to be promoted to the status of partner.

The associates are valued for their billable hours, and are effectively required to bill almost all of their time. As they become more senior, their ability to attract new business becomes more critical. "Billable hours" means that they have an account to which they can charge their time. Lotus Notes, the revolutionary technology, was not provided to them with a "training account" to which they could bill their time. Consultants who wanted to use Notes had to have an account to charge their time against, and the initial learning time was in the order of 20 to 30 hours. In 1991, the consultants were billing at about $150 an hour, so they had to find a client who would be willing to pay $3,000 to $4,500 for them to learn a system whose value wasn't yet clear to them. Many had trouble justifying that amount of expenditure to any of their clients at the time that they were participating in the Notes rollout. There was also an important question as to what the consultants would actually do with Notes after they learned how to use it. Consequently, relatively few associates saw much value in Notes, and there were no exemplary demonstrations showing them how other successful line consultants used Notes.

On the other hand, partners have substantial job security (similar to university tenure). They could afford to experiment with Notes. They were more willing to invest some time to explore, often using e-mail, occasionally developing and sending memos, and so on. Overall, this case study contradicts the popular "Nintendo generation" explanation: "In the future, we don't have to train people about computing, because the Nintendo kids (or the Net kids) will learn quickly." In this case the younger consultants generally had less incentive to learn Notes than did the middle-aged and older partners.

What about the information technology staff and the tax consultants? These groups also had an advantage in their forms of job security. Many of the information technology staff were technophiles who liked to work with

interesting new applications. Lotus Notes has been helpful for people who can invest time in learning how to use it, especially when they have joint projects and substantial motivations for communicating, for documenting work, for sharing memos, and so on.

The tax consultants, who were located in Washington, D.C., had significant incentives to show their visibility in and value to the firm. Their fixed salaries were not based on billable hours, and this allowed them more freedom to explore Notes' uses. Lotus Notes allowed them to broadcast for visibility. It gave them the ability, in effect, to electronically publish their advice and make it quickly available to many of the consultants around the firm who wanted to read the Notes database. They hoped it would enhance their visibility, and thus show that the Washington office was not just overhead, but an important, contributing part of the firm.

In short, although they proved to be of considerable importance, organizational incentive systems were not part of the original marketing story of Lotus Notes. It was the interesting information processing features enabled by Lotus Notes that were emphasized in numerous stories in the technical press (see for example, Kirkpatrick, 1993).

This case illustrates varied consequences of Notes' use in a large consulting firm, as opposed to one fixed effect. Finding such varied, conflicting consequences in different settings is common in this body of research. Social Informatics researchers do not simply document the various consequences of computerization, but also to develop empirically grounded concepts that help us to predict (or at least understand) variations in the ways that people and groups use information technologies (Lamb, 1997; Robey, 1997). For example, analysis of the different organizational incentive systems for different professionals increases understanding of the disparate outcomes in the case discussed here. (Also see Markus and Keil, 1994, for a case study of a little-used, large-scale expert system whose use was not supported by organizational incentive systems.)

One key idea of Social Informatics research is that the "social context" of ICT development and use plays a significant role in influencing the ways that people use information and technologies, and thus influences their consequences for work, organizations, and other social relationships. Social context does not refer to some abstracted "cloud" that hovers above people and ICTs; it refers to a specific matrix of social relationships. The social context may also be characterized by particular institutional relationships. For example, one set of institutional relationships would be the incentive systems for organizing and sharing information at work. In the case just described, different groups within Alpha have different incentives to share information about the project "know-how," and this affects their use of Lotus Notes.

The use of the World Wide Web (or Web or WWW) in university instruction today is another contemporary example. A growing fraction of university faculty are eager to explore the Web as a way to enhance some aspect of their teaching—whether it is making class materials more readily available to their students, developing online discussions, or devising new forms of interactive activities. Many other faculty, especially nontechnical faculty at research universities, are much less interested in working with the Web because they believe that using it would require a lot of their time to learn HTML and other ICTs, to develop and maintain materials, and so on. These stances are further mediated by the extent to which the faculty's departments provide technological help or teaching assistants to help with the development of Web materials. There are many other contingencies that can influence the ways that university faculty interpret the Web in relation to their teaching. The main point is that these interpretations are not uniform—people's interpretations of an ICT are based on prior beliefs, and the perceived new opportunities and demands it creates relative to their other opportunities and commitments. How people interpret an ICT is of considerable importance because people (and organizations) with different interpretations will adopt and use ICTs differently.

2.1.2 ICTs Enable and Constrain Social Actions and Social Relationships

ICTs are sometimes called "technologies of freedom" because they extend the abilities of people and organizations to access data, communicate, and so on. It is common for many technology-centered accounts of new ICTs to emphasize the ways that they enable new kinds of action that were previously more costly, difficult, or impossible. However, many of the ICTs' freedoms come with some less visible constraints.

The shift from paper to electronic documents offers some interesting examples. People who work with paper documents often face the constraints of needing to travel to a library to obtain them. However, once they are in hand, they can be read virtually anywhere. In contrast, digital libraries open the possibility of having documents accessible on one's desktop. However, unless they are then printed out, people can't easily read them on planes, in bed, at the beach, and so forth.

Researchers frequently find that ICTs, in use, do not simply "open new possibilities" for organizational action, for organizing work, for professional communication, for supporting education, and so on. Rather, they restructure existing information processing and the social relationships which surround these (Sawyer, Crowston, Wigand, & Allbritton, 2003). For example, a work team may use group calendaring software to help coordinate its activities.

One advantage is that the team's members may be able to more easily schedule meetings. However, team members must also bear additional responsibilities to keep their own schedules up-to-date, and thus to log in as they schedule and reschedule meetings and other activities during their workdays (Pino & Mora, 1998).

The ways in which developers and local implementers configure ICTs to restructure social arrangements can take place at the level of whole organizations as well as in smaller scale settings such as work groups. To manage increasingly complex supply chains, streamline business processes, and coordinate resources around the world, a growing number of the world's biggest corporations are implementing enterprise-wide IT management systems that are supposed to facilitate sharing data and tracking operations both around the world and across functional areas. As we noted previously, enterprise systems are touted as a means of reducing the operational and maintenance costs of running stand-alone systems and providing an opportunity to implement real global change. Today, many large business firms are investing hundreds of millions of dollars each in enterprise systems. These systems may be spoken of as tools to help people manage more effectively. But, in practice, each enterprise system tends to impose a more centralized information structuring regime on a firm.

Some managers have found enterprise systems to be congruent with their current management practices, whereas others have restructured their businesses to fit the constraints of their new enterprise systems. A few organizations have abandoned enterprise integration projects after spending up to $500 million because the gains from the systems did not seem worth the new constraints (Davenport, 1998). Some of these firms reverted to information systems whose architectures better supported their more decentralized ways of managing and working. In a few cases, the firms embarked on developing new enterprise system projects whose technological architectures seemed to offer a more appropriate set of opportunities and constraints.

2.1.3 ICTs Provide a Means to Alter Existing Control Structures

When first introduced into social and organizational settings, the relationship between ICT use and social structures is reciprocal. Organizational informatics researchers have found that ICTs can restructure workplaces through the ways in which they are incorporated into the everyday lives of those who use them (Barley, 1986, p. 81). Technologies are also shaped by the everyday actions of those who routinely use them and the social settings within which they have been implemented (Orlikowski & Robey, 1991, p. 151). However, organizations come to stabilize around some configurations of work practices

and ICT configurations. Thereafter, changes are incremental until there is some substantial "outside change"—such as changing physical locations, a shift to a new kind of ICT, a major shift in the mix of work or services being produced, and so on.

Once organizations stabilize around some technological configurations (especially standards for complex infrastructures such as networking protocols, operating system families, and databases), they become taken for granted and institutionalized in ways that impede other subsequent innovations (Kling & Iacono, 1988). For example, in the early 1980s, mainframes or minicomputers running large database management systems and analytical programs and connected to workers via "dumb terminals" dominated the organizational computing landscape. Few central information systems organizations supported PCs or encouraged their use. Many departments obtained their first PCs when professionals and managers "snuck them in"—by hiding their purchases under safe accounting categories, such as "word processors" or "engineering instruments," or even by physically carrying their own PCs into their offices.

The range of contemporary policies about access and use of the Internet and e-mail reflects the ongoing efforts to create institutional stability. That is, computerization efforts (whether they achieve their intended goals or not) affect the ways in which people organize and interact. Thus, current controversies about Internet use reflect this same tension between institutional stability and technological innovation. For instance, librarians must balance community opinions of decency against patron's first amendment rights to access indecent materials at public computers in local libraries. Policies regarding the use of organizational computers to access certain Web sites, send e-mail of certain types, and do other things online vary by both organization and status within organization. Further, the rapid growth of peer-to-peer file sharing and the problems with enforcing intellectual property rights in the face of widespread digital music sharing is destabilizing the music industry (and threatening many other industries whose revenue is based on trade of intellectual property).

Control structures are often built into ICTs and these often enforce gender, race, and socioeconomic class distinctions. For example, as Hoffman (1999) notes, in the early designs of word processors, designers provided fixed-path menu structures and rigid document controls. Designers believed that the users (primarily women) would need this extra control because they did not understand computers. However, the users were experts at typing, and the enforced control structures inhibited their ability and reduced their productivity. Hoffman further notes that, as word processors were redeveloped for knowledge workers (primarily using masculine views of knowledge workers) the control structures were minimized.

2.1.4 There Can Be Negative Consequences of ICT Developments for Some Stakeholders

New ICT developments are usually promoted by their sponsors in terms of their foreseeable, direct benefits to some groups. However, it is common when mobilizing support for them to downplay or ignore their disadvantages. For example:

- Many large business firms introduced Enterprise Resource Planning (ERP) systems that could help them to streamline their information flows, solve Year 2000 problems, save support costs by having a common systems infrastructure, and provide a '"platform"' for future computing growth. However, deploying these systems has led to significant centralization in some firms, as well as disruption (Davenport, 1998; Markus, Axline, Petrie, & Tanis, 2000).
- Many business firms, large and small, are encouraged to develop Web sites as a way of enhancing marketing and increasing their sales. However, many are losing significant amounts of money on their efforts at electronic business (Grover, 1999; Nelson, 1999)—with resulting stress on their staff.

Many new developments have some negative consequences that key stakeholders did not want. Lynne Markus's (1994) careful case study of the social consequences of e-mail use between the staff at the headquarters of an insurance firm (HCP) helps to illustrate this idea. She found that HCP's upper managers required their staffs to rely upon e-mail, and it was the major medium for internal corporate communications at the time of her study. HCP's staff used e-mail to speed communications and bring people closer together. But they also reported significant negative effects, such as feeling that HCP was a less personal place to work. Electronic mail was often used to avoid face-to-face confrontation or unpleasant situations, and often in-office visitors were ignored while employees tended to the demands of messages on their computer terminals.

Systematic use of ICTs changes the nature and extent of social life in ways that may improve some kinds of social relationships and activities at the expense of others (Wellman, 2001). One common and typically unintended outcome of computerization efforts are systematic political repercussions: the new ICT leads to "winners and losers" (Danziger, Dutton, Kling, & Kraemer, 1982; Markus 1981, 1983). For example, Kraut, Dumais, and Koch (1989) show how repeated attempts to support phone operators with automation led to an unintended reduction in the quality of their work life.

Sometimes negative repercussions from computerization are relatively minor, and the benefits of computerization may be of much larger value to many participants. Sometimes the negative repercussions loom large for people who have the power or influence to block a computerization project, or to alter the ways in which systems are used. As an example of the latter, Saetnan (1991) studied the attempts of designers of a surgical room scheduling system, PREOP, to have it adopted in Norwegian hospitals. PREOP was supposed to make more efficient use of staff time and physical resources by automatically scheduling arrangements for operations. However, Saetnan found that the scheduling algorithms did not effectively mesh with the work of doctors and nurses. After some frustration, the staff used the computer system simply to record schedules rather than to optimize them. The nurses had significant influence in scheduling the rooms, and were reluctant to submit to the surgeons, whose preferences were reflected in the design of the new system. Saetnan notes:

> Having learned to master PREOP by overriding parameters, nurses could force PREOP to set up schedules exactly as they had before. … PREOP became a slave to the old routines and thus reinforced them (Saetnan, 1991, p. 434).

Although the creation of "losers" from the implementation of ICTs may be done purposefully on some occasions, or considered an unavoidable side effect at other times (such as with the phone operators), there are times, as at HCP, when no one foresees the negative impact that some people will experience from computerization. No one "wanted" HCP to feel like a less personal workplace. Even so, HCP's employees integrated e-mail into their work lives in ways that sometimes added barriers between themselves and their colleagues.

One group may also be able to force another group to use an ICT in a way that disadvantages them (Kling, 1980, 1983; Markus, 1981). For example, Clement and Halonen (1998) examined how user groups and information systems specialists in a large utility company differed in their conceptualizations of a "good" system and good systems development practice. According to Clement and Halonen, for the users, a good system should be customized for different offices such that use required minimum knowledge of office-specific codes. This would require code customization for each office, resulting in the existence of multiple unique versions of the software and a great deal of ad hoc programming. From the information systems perspective, good systems development practice requires standardization, version control, and minimal code changes. This approach would lead to the creation of a less user-friendly system that requires more end-user expertise.

Clement and Halonen's study showcases the ways in which different conceptualizations of a good system and good systems development practices benefit one group more than another. User groups favored the ad hoc, customized development practices because they resulted in a more flexible, customizable, user-friendly system. The information systems group preferred a more structured, systematized approach to development because it resulted in a more easily manageable software product.

As these examples illustrate, the distribution of good and bad effects of ICT use is political; these outcomes are not inherent in the features of the technology. The choice of which groups gain or lose through using an ICT is a political decision and these gains and losses reflect *configurational* actions (those taken to shape the design and use of an ICT) (Fleck, 1994). For example, in one large university, the central ICT staff changed the technical protocols that supported e-mail use in order to make better use of new central mail-server computers. The transition to new mail servers was well advertised. What was not well advertised was that the central ICT support staff was also dropping support from some popular e-mail programs that they had previously distributed. Faculty, staff, and students who used these e-mail programs learned about the loss of support only when their e-mail did not work properly on the new e-mail servers. Their phone calls to a university ICT help center put them in contact with sympathetic staff who were unable to help because they were not taught how to advise about problems with e-mail software no longer being supported.

In retrospect, it appeared that the central ICT staff continued to support and had tested the e-mail packages that they preferred in their own work lives. Some e-mail packages that were preferred by faculty or students who worked at home as much as on campus were not used in the central ICT organization. Support for these e-mail packages was quietly dropped to help simplify the work of the university's ICT organizations. It was possible to configure these programs for the university's new e-mail servers by finding technical tips that were posted on the Web of central support organizations at other universities! But this technical self-help was very disruptive and unnerving for the faculty and students who spent several hours doing it, while their professional communication via e-mail was unexpectedly interrupted. In this example, the faculty, students, and staff who used the e-mail packages that were personally preferred by the central ICT support staff were advantaged while those who relied upon different (and often functionally better-sorted) e-mail packages had their professional lives disrupted.

2.2 The Technical Nature of ICTs

In this section, we highlight findings from Social Informatics literature that focus on the technical consequences of ICTs. In doing this, we note that the ways in which we conceptualize an ICT underlies any discussion of its technical attributes (Orlikowski & Iacono, 2001). In Social Informatics literature, ICTs are typically conceptualized as part of a larger socio-technical ensemble, and their particular use or value is portrayed in functional ways (Sawyer & Chen, 2002). This functional view contrasts with computational or feature-based conceptualizations that highlight the algorithmic or designer-centric representations of an ICT.

2.2.1 ICTs Play Both Communicative and Computational Roles

Proponents of both direct effects and systems rationalist theories of computerization tend to emphasize only some of an ICT-based systems' information processing features, such as the size and contents of the corpus of a digital library or the mathematical approach of a forecasting model. However, ICT-based systems usually play communicative roles as well. The earliest computer-based systems tended to emphasize computational capabilities, primarily for diverse scientific applications and business data processing, and this focus often manifests itself in current conceptualizations of the role of computing. However, groupware applications that are designed to enhance teamwork must be viewed in communicative terms. For example, Guinan, Cooprider, and Sawyer (1997) found that software engineering tools, designed to support computation, were more often used to support communication. Similarly, computer networking, heightened by the multimedia presentations in the Web, highlights the communicative roles of today's advanced information technologies.

Human communication plays a role in systems that emphasize intensive computation, as well: The mathematical models that are supposed to enhance human decision making are interpreted within settings where communication between people is preeminent. Professionals and managers discuss (and negotiate) the assumptions behind mathematical models, their structure, the results of modeling runs, and their meaning (Dutton & Kraemer, 1985).

Sometimes computer systems provide important social communication channels and media. Kling and Iacono (1984) report on large manufacturing firms that used certain computerized inventory control and production scheduling systems, called MRP (Material Requirements Planning) systems. These MRP systems are transaction-oriented ICTs whose data refer to materials (e.g.,

quantities of parts and subassemblies to be ordered or manufactured by certain dates). Direct effects and systems rationalist theories both emphasize the ways in which the use of MRP can help reduce operational costs by significantly reducing inventories. However, Kling and Iacono found that an MRP system can also serve as a social control system because it gives the staff in various departments information about the detailed activities of those in other departments. For instance, purchasing departments are responsible for ordering parts, and different manufacturing departments are responsible for transforming purchased parts or grouping them in subassemblies. Manufacturing staff can attribute chronic shortages in certain kinds of parts, such as electronic circuits or motors, to the specific employees who specialize in buying that family of parts. Similarly, manufacturing staff can use an MRP system to track the performance of other departments in constructing subassemblies or in performing related activities, such as inspection and testing. Acknowledging the communicative aspect of ICTs is important because it increases our understanding of their uses and consequences by including the *social behavior* of people who use them.

2.2.2 There Are Important Temporal and Spatial Dimensions of ICT Consequences

Some of the popular conceptions of the consequences of ICTs for space and time are misleading. Despite the advertising cliché that "computer networks eliminate space and time,"' the reality is that organizations have been able to reduce only some of the temporal and spatial barriers for work, communicating with clients, and so on. Woody Allen once joked that "history is God's way of keeping everything from happening all at the same time." Using an ICT that seems to eliminate the user's dependence on space and time might seem to offer tremendous convenience for individuals and organizations. However, because these users could also be continually accessible to others—regardless of their locations or time zones—they could be easily inundated with communications and demands. This overloading is particularly likely when people work on multiple projects, with several teams, and support many clients.

Clearly, ICTs are enabling people and organizations to reduce some of the communicational restrictions of space and time—in ways that we do not understand very well (Lee & Sawyer, 2002). Time and space are also important considerations in understanding how long the consequences of ICTs take to show up, and where. The consequences of ICT deployments may be relatively immediate (i.e., develop over weeks or months), especially when their use is essential and requires only a few well defined and easily learned skills. Or their consequences may take time to build. For example, a new digital library or

electronic journal may take several years to develop a constituency, especially when use is discretionary and the people who may potentially use it have alternative information sources.

2.2.3 ICTs Rarely Cause Social Transformations

Much of the popular literature about ICTs and social change emphasizes "social transformations" and the ways in which ICTs create new social worlds. Empirically oriented Social Informatics researchers who carefully study ICTs and social change find that the pace of change is relatively slow, and that there are usually important continuities in social life in addition to the discontinuities. For example, bold claims have been made about how ICTs have "transformed work." Guevara & Ord (1996) claim that, "The nature of work is currently undergoing a complete transformation. … Information technology is underpinning this transformation" typifies a commonplace claim in the business and technology press. Some pundits go further in emphasizing the rise of virtual offices, the replacement of jobs with project-level assignments, the demise of large organizations, and so on.

Certainly in the U.S., work life has changed in many ways in the twenty years since PCs became popular. However, some of the shifts have come from a changing mix of work—from manufacturing production to services. Other shifts are the result of increasing numbers of professional and managerial jobs requiring heavy travel as firms scale up geographically. Kling and Zmuidzinas (1994) found that managers had at least 18 different directions in which they could reorganize work.

In practice, computerization projects play only modest roles in restructuring white-collar workplaces. As Brooks (1987) noted in the context of software engineering, there are no (ICT-based) '"silver-bullets." Ten years later, Guinan, Cooprider, and Sawyer (1997) provided empirical evidence that the presence of CASE tools did not radically change software engineering. Similar findings arise from other industries. Salzman (1989) noted that the increased use of Computer-Aided Design (CAD) in engineering did not remove engineers, as it was predicted to do. Fleck (1994) points out that MRP systems did not restructure work as much as they reinforced traditional roles (shop floor worker, manager, technology specialist).

As Markus and Benjamin (1997) note, workplace change is more multifaceted than is suggested by direct effects models that espouse "ADD ICT AND GET CHANGE." As both Burkhardt (1994) and Liker, Roitman, and Roskies (1987) find in separate studies of organizational change following technical change, long-term changes reflect larger organizational, industrial, and economic forces and have little to do with changes in ICT. Beyond organizational

work, Sawyer, Crowston, Wigand, and Allbritton (2003) find that extensive computerization of real estate agents in the U.S., and the growth of house-hunting data available to buyers and sellers on the Web, has not radically restructured the work of these agents.

2.3 The Institutional Nature of ICTs

In this section, we develop an institutional perspective on ICTs. As we explain below, institutions are enduring social structures. We note that ICTs are embedded in, help to shape, and are shaped by institutions. In the rest of this section, we review the various forms of institutions, the nature and means of embedding, and the political nature of their actions in shaping these institutional contexts.

2.3.1 Social and Technical Consequences Are Embedded in Institutional Contexts

Institutions, the most enduring and general type of social organization, can range from highly formal and public organizations, such as banks and governments, to more private organizations such as families, and even to loosely structured organizations such as the soccer leagues to which families might belong (Scott, 2001). Institutional memberships may overlap in complex ways: A banker may have a child in the soccer league being coached by one of his clients. Moreover, most people navigate this institutional complexity, moving in and out of a range of institutional settings in their daily lives, with a great deal of dexterity.

The institutional embeddedness of ICTs means that they cannot be conceived of or discussed outside of particular institutional arrangements. As the Lotus Notes case makes clear, differences in professional practices within one formal organization lead to different responses to the same ICT. This makes discussions of best-practices-with-ICT tricky. That is, the practices situated in institutional context "*A*" are not always transportable to institutional context "*B*." For example, Markus, Axline, Petrie, and Tanis (2000) note that, although general patterns are clear, specific practices relative to implementing ERP vary among adopters. Important elements of the ERP (such as the centrality of certain modules and functions) may vary for each implementer.

2.3.2 ICTs Often Have Important Political Consequences

In scientific and technical communities, the term "politics" often has an ambiguous status. When analysts use it to refer to governance processes in

the larger society, such as the election of public officials, debate on public policies, development of legislation, and so forth, it can have a positive valence. However, scientists and technologists often view the term "organizational politics" with some distaste, as if political processes are necessarily dysfunctional and inappropriate. In fact, in the 1960s and 1970s, some analysts had hoped that computer models could take "the politics out of decision making" inside organizations as well as within public agencies. This hope was not realized (Dutton & Kraemer, 1985).

Researchers who study organizations have found that organizations do not function simply as task or production systems. In practice, a view of organizations as political networks has added an important dimension to the study of organizations generally and to understanding the roles of ICTs in organizational change in particular (Danziger, Dutton, Kling, & Kraemer, 1982; Laudon, 1974; Markus, 1981; Pfeffer, 1981). When viewed as political networks, organizations can be seen to have governance structures, ways of allocating important resources, and ways of legitimizing their actions. Groups within (and outside) an organization are often trying to influence a specific organizations' governance, allocations, or forms of legitimization. Organizations differ in the forms of their political networks: Some are more autocratic whereas others allow (and sometimes even encourage) conflict between competing groups and coalitions. When ICTs are significant organizational innovations they require money and staff to acquire and implement, and it requires some legitimacy to restructure other people's work to align with the new practices that the ICT is supposed to enable.

For example, e-mail systems enhance professional communication only when people actually use them. In the late 1980s and early 1990s, many managers, professionals, and technologists who were enthusiastic about e-mail tried various ways to make e-mail use appropriate and legitimate in their organizations. From a political perspective, e-mail is not simply a "technical solution" that helps solve communication problems (such as reducing the frequency of "telephone tag" between people who are not always in their offices). Researchers have found that e-mail use can give greater visibility (and thus influence) to "peripheral participants," such as people who work at night or in field offices (Sproull & Kiesler, 1991). In this way, e-mail has "political outcomes"—some people gain influence (and resources) while others do not.

In the mid-1960s, political scientist Anthony Downs speculated about the power payoffs of ICTs in organizations and argued that power would shift toward those who collected information. Organizational informatics researchers have found that many ICTs actually can shift the balance of influence and power in organizations by restructuring access to information, technical staff, and the level of legitimacy that informational resources can bring (Danziger, Dutton, Kling, & Kraemer, 1982). Political processes are not

static, and political analysts examine the ways that groups jockey for influence as the nature of the opportunities, stakeholders, coalitions, and so forth change over time (Kling & Iacono, 1984).

One important contribution of the political networks view of the role of ICTs in organizational change is that it helps to deepen our understanding of the motivations for different groups supporting and opposing specific forms of ICT developments. Markus (1981) explained the support and opposition for a new centralized accounting system in terms of perceived power shifts. Her explanation contrasts with that of analysts who view people's support or opposition to new ICTs as a psychological disposition of being either pro-innovation or technophobic. In a rich case study, Markus showed how the professionals who supported a new system were those who expected to gain influence from its use, while those who opposed it expected to lose control over their data through its use.

Hodas (1996) developed a power-based analysis of many school teachers' indifference or opposition to ICTs in K–12 schools. He observed that many K–12 teachers place a high value on having control over their students (such as having quiet, orderly classes). Many computerization projects in K–12 schools can upset teachers' control strategies because they require students to move around within classrooms, or between classrooms and laboratories. In addition, for a variety of reasons, children can develop greater expertise in computer use than their teachers (including time on task), and many teachers fear that their authority through expertise will be undermined.

Kenneth Laudon (1974, pp. 164–166) found that the relative power of central administrators was critical in determining whether and how information systems are adopted in county governments. This insight may help explain some of the implementation failures of enterprise systems (mentioned earlier). For example, groups that have sufficient power and perceive threatened reductions in their influence may thwart the efforts of headquarters-based managers and technologists who try to impose a more centralized managerial regime on them. Today, some of the debates about the value of electronic scientific publishing could be usefully examined from the perspective of expected gains and losses of scientific influence. These power-oriented explanations differ from those explanations that simply focus on the advantages an ICT will afford some group.

Endnotes

1. For a more complete discussion of this case, see Kling, 2000.
2. Alpha's unusual mass purchase of Notes for all of their consulting staff was the subject of several reverential stories in the technical and business press.