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What is Social Informatics and Why Does it Matter?

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1.0 Introduction

A serviceable working conception of "social informatics" is that it identifies a body of research that examines the social aspects of computerization. A more formal definition is "the interdisciplinary study of the design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts."

It is a field that is defined by its topic (and fundamental questions about it) rather than by a family of methods, much like urban studies or gerontology. Social informatics has been a subject of systematic analytical and critical research for the last 25 years. This body of research has developed theories and findings that are pertinent to understanding the design, development, and operation of usable information systems, including intranets, electronic forums, digital libraries and electronic journals.

Unfortunately, social informatics studies are scattered in the journals of several different fields, including computer science, information systems, information science and some social sciences. Each of these fields uses somewhat different nomenclature. This diversity of communication outlets and specialized terminologies makes it hard for many non-specialists (and even specialists) to locate important studies. It was one impetus for coining a new term -- social informatics -- to help make these ideas accessible to non-specialists, as well as to strengthen communication among specialists, and to strengthen the dialogs

between communities of designers and social analysts.

This article discusses some key ideas from social informatics research and ends with a brief discussion of the character of the field today. Readers who wish to understand social informatics by learning about its origins and influences may wish to start in that later section and then return to the beginning for a more substantive focus. This article serves as a brief introduction to social informatics for information technology professionals and researchers, and includes numerous references to help interested readers readily locate more comprehensive resources.

2.0 Punditry About Information Technologies and Social Change

There are alternatives to systematic research about information technologies and social change. *Wired Magazine's* articles often illustrate one popular alternative -- vivid punditry. In the January 1998 issue, journalist George Gilder wrote about the way that computing power has increased a hundred millionfold since the 1950s. Computer scientist Danny Hillis wrote about the ways that computerization is leading to a transformation of a new civilization in a few paragraphs and with high spirits. This kind of opinionated journalism is very readable. *Wired* is colorful, both in its prose as well as its typography, and it lends itself to new sound bites. Unfortunately, it doesn't lead to the kind of deep understanding which many information technology professionals need.

Wired exemplifies the magazines that offer energetic prose, but information technology pundits, such as Esther Dyson, communicate in many other forums as well, such as their own books and conference talks. Pundits play interesting social roles. The best pundits are entertaining, provocative and timely. If an issue arises this week, they can rapidly formulate an articulate opinion, and perhaps even a sound bite. In simplifying, they often oversimplify and polarize issues. Unfortunately, the typical pundit relies upon anecdotes and bold assertions, rather than using them as entry points for analysis. Pundits usually rely upon their own experience as a basis for expertise and don't encourage serious and systematic research into information technology and social life (see Nimmo and Combs, 1992).

Professionals are sometimes involved in very prosaic work in designing information systems, selecting and configuring equipment and developing policies and practices about the use of the resulting systems (i.e., which data to collect and archive, how to identify authorized users, how to organize training and consulting). The details of this development work differs substantially for systems as varied as claims management for an insurance company, a litigation support system for a law firm, and a public-access on-line library of self-help medical bulletins supported by a public health agency. However, social informatics researchers have developed some fundamental ideas that can help

improve professional practice and that pertain to a diverse array of information systems.

The design and configuration of information systems that work well for people and help support their work, rather than make it more complicated, is a subtle craft. Good application design ideas are neither obvious nor effective when they are based on technological considerations alone. Their formulation requires understanding how people work and what kind of organizational practices obtain. However, many managers and professionals often advance simple criteria to help guide computerization strategies, such as:

1. use more advanced technology (whether it is faster or easier to use);
2. use "better technologies," (though there are different criteria for "better" such as less expensive or compatible with other equipment); or
3. organize systems so that they are more efficient.

There are other guidelines, such as replacing repetitive human activity with computer systems or devising computer systems to leverage an organization's value chain. These kinds of context-free guidelines have not been good enough to help information technology professionals design or implement effective systems.

Their limitations will be illustrated by the examples that I develop in the following sections. Before I launch into a discussion of some interesting ideas from social informatics research, I will discuss one important phenomenon that helps sets the stage for the importance of social informatics for information technology professionals -- "the productivity paradox."

3.0 The Productivity Paradox

Between 1960 and 1980, computer use and productivity gains were linked together -- in the writings of economists, in the advertisements for new computer systems, and even in the expectations of many working people who feared that widespread computerization could lead to a society with massive unemployment. As the costs of acquiring computers rapidly declined, many North American organizations, public and private, increased their investments in computerized systems. In the late 1980s, U.S. firms were spending approximately half of their capital funds on computers and telecommunications. Economists noticed that national statistics for labor productivity were not steadily increasing, and some managers noticed that large investments in PCs did not seem to translate into major productivity boosts.

Since the late 1980s, the U.S. business press has trumpeted the expectations that computerization would soon lead to productivity spurts and also published stories that dash such hopes. A set of stories from *Business Week* illustrates the conflicting themes in the business press. In February 1994, *Business Week* published two short articles by Gene Koretz: "Computers may really be paying

off: effect of automation on productivity in the workplace" and ... "And they're giving the U.S. a nice competitive edge." In January 1995, *Business Week* published a short article by Dean Foust, "Is the computer boost that big? Computers do not enhance productivity very much."

Economists also differed in their beliefs about the relationship between computerization and productivity growth. Many believed that technological innovation was a major factor in national productivity and assumed that investments in information technology would be reflected in national statistics when the cumulative capital stock of computer systems was large enough, they would result in improved productivity statistics. Some economists coined the term "productivity paradox", after Nobel laureate economist Robert Solow (1987) wrote, "You can see the computer age everywhere but in the productivity statistics." Solow's assertion counters the common assumption that computerization would directly and dramatically improve productivity. Economists were divided in their explanations of the productivity paradox. Some believed that their ways of measuring productivity were inadequate; others argued that the capital stock of information technology was still too small to have meaningful consequences in national economic statistics; and still others argued that lag effects were being underestimated. Still others believed that mismanagement was a root cause of the productivity paradox.

The "productivity paradox" is also an important social phenomenon. Unfortunately, it is ignored in the technophillic press, such as *Wired Magazine*, and is glossed by most of the pundits. Within the United States, annual economic productivity has been growing at a much slower rate in the mid-1970s through the 1990s than in the 1960s. For example, labor productivity in nonfarm business grew by 2.8 percent from 1960 to 1973 but grew by only 1.1 percent from 1973 to 1996 (Webb, 1998). While the specific rates of growth of labor productivity vary with the years counted, and do vary within economic sectors, the general pattern of reductions in measured labor productivity growth rates in the last two decades is well accepted among economists.

Certainly many things have changed in industrial societies between the first 20-year period after World War II and the most recent 20-year period. One set of changes is the proliferation of, and the very deep investment in, computer and telecommunication systems. Since the late 1980s, private firms in the U.S. have been investing about half of their capital in information and communication technologies. That investment includes telephone systems and voice mail as well as computers. Still, it is a large fraction, and it has been sustained since the "PC revolution." There has been a fairly intensive purchasing campaign, and an increasing computerization campaign in major firms, and it is beginning to show up in cumulative technology investments on a significant scale.

This is the very period in which productivity gains are not going up by a factor

of a hundred million -- the number that Gilder (1998) likes to give as the gain in computing value since the 1950s. In the U.S., labor productivity has grown 2-4% per year in this period. Many people have assumed that computerization should directly and dramatically improve productivity. Newer computer and telecommunication systems may offer many advantages over traditional media or even older computerized systems. However productivity gains may be hard to achieve with the low-volume high-variety computer applications that many professionals use. These may be called "productivity tools" but they may do more to help improve the appearance of documents and presentations, to deepen analysis, and to improve control over one's work relationships -- especially with reduced secretarial support. These are valuable gains, but they may not translate into "throughput productivity."

Some economists are concerned about these matters and believe that the productivity paradox is primarily "not real." It will be resolved by improved ways to measure productivity and actually a larger investment in computer systems. There is a lively debate between economists and organizational analysts (see Kling, 1996b). Organizational analysts suggest explanations that range from "We haven't learned how to use computers well enough at an organizational and social scale" (King, 1996), through describing many organizational processes and work practices that reduce productivity in practice (Attewell, 1996). Such work practices include managers generating more numerous, fine grained reports from information systems, authors making numerous interim drafts of manuscripts, people fiddling with malfunctioning computer systems, and so on. The managerial reports may help managers feel more confident in taking certain actions, the incrementally revised manuscripts may be improved, and so on. But these practices don't increase "throughput productivity."

There are several social explanations for the productivity paradox: (a) many organizations develop systems in ways that lead to a large fraction of implementation failures; or (b) few organizations design systems that effectively facilitate people's work; or (c) we significantly underestimate how much skilled work is required to extract value from computerized systems. Taken together, these observations suggest that many organizations lose potential value from the ways that they computerize.

Some recent studies indicate that information technology investments have improved the productivity of some organizations and national economies in the 1990s (Brynjolfsson and Hitt, 1998; Dewan and Kraemer, 1998). However the firm-level data shows substantial variation across firms (Brynjolfsson and Hitt, 1998: p.52). The evidence is accumulating that organizations which computerize intensively with appropriate organizational practices are more productive than the average, while those that do not organize appropriately lag behind the firms that do not computerize intensively. Brynjolfsson and Hitt (1998: p.54) estimate that the inappropriately organized, highly computerized

firms lag the appropriately organized, highly computerized firms by 10 percent.

Resolving the productivity paradox lies in the future. The productivity paradox gives us reason to believe that current strategies of computerization do not readily produce expected economic and social benefits in a vast number of cases. In particular, technology alone, even good technology alone, is not sufficient to create social or economic value. This discussion offers an entry point into an interesting set of studies and theories about the ways that effective computerization depends upon close attention to workplace organization and practices. I will discuss this idea in greater depth later on.

4.0 Early Research in Social Informatics

Through the 1970s and 1980s, much of the social informatics research focused on organizations because they were the major sites of computerization. It is only in the last few years that many people who are not themselves technical specialists have gotten computer systems for home use. The era of the Internet, or particularly public access to the Internet, raises issues of work at home, communication at home, entertainment, access to medical information, and other personal uses. These are significant phenomena, but are different from the topics I will emphasize. They are part of social informatics, but they open up different lines of analysis that warrant serious study and understanding (see, for example, Anderson, et al. 1995; Kahin and Keller, 1995).

In the 1970s and 1980s, often the questions about computerization were phrased as deterministic impact questions, such as: "What would be the impact of computers on organizational behavior if we did X?"; "What would be the changes in social life if we did X?"; "Will computer systems, for example, improve or degrade the quality of work?" There are a number of studies in which people try to answer this last question, whether work life would improve for clerks, for engineers, for managers, and so on. The questions were often phrased in very simple, direct terms, namely: "What will happen, X or Y?" And the answer was: "sometimes X, and sometimes Y." There was no simple, direct effect. Much of the character of changes depended on the relative power of workers. For example: clerks fared less well, on the average, than professionals. But sometimes secretaries, who are the aristocrats of the clerical class, were able to have greater improvements in their worklives than were the people, primarily women, who were doing transaction processing in the back rooms of banks and insurance companies. Occupational power played an important role in mediating and shaping the way that computerization restructured workplaces (See Kling, 1980; Attewell, 1987; Iacono and Kling, 1987).

Other sets of questions were also examined. To what extent were organizations centralized? There were major arguments that computer systems would enable upper managers to have much more detailed information about the operations

on workplaces, such as the shop floor, the editorial room, and the classroom, and that organizations would become more centralized. Others argued that they would become more decentralized. Many people wanted to know: "Well, which is it? Is it A or B?" Some studies found that information technology use led to some organizations centralizing, and other studies found that information technology use led to decentralization. Many of the arguments which were engaged in a form of "Is it A or B?" were based upon simple technological determinism which has not been borne out in reviews of the careful studies (see King, 1983; George and King, 1991). The analytical failure of technological determinism is one of the interesting and durable findings from social informatics research.

Today some analysts (and many pundits) frame claims about information technology in social life in deterministic ways, with claims such as, "The Web means that the public will get better information than ever before." That framing is one that people who study social informatics would be skeptical of. We ask: "When will the Web enable the public to locate 'better information'? Under what conditions? Who? For what?" Are people seeking information to help them make a better choice of doctors, and then placing more trust in that doctor. Or are people seeking alternatives to doctor-mediated medical care -- whether information about health, herbal medicine or post-operative care? Those contingency questions don't lend themselves to lively sound bites. But they do yield a very nuanced professional understanding. This kind of *contextual inquiry* illustrates the ways that social informatics researchers frame questions to develop an analytical understanding of information technologies in social life.

5.0 Some Key Ideas of Social Informatics

5.1 How Social Context Matters: Intranets in Action

One way to illustrate a *contextual inquiry* of information technology in social life is to discuss some studies of the ways consulting firms have adopted and used computerized documentary systems[1]. One major consulting firm, Price Waterhouse, bought 10,000 copies of Lotus Notes, documentary support system for their staff in 1989. Lotus Notes is superficially similar to an Internet-like system with bulletin boards and posting mechanisms and 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.

Price Waterhouse is an international consulting firm with tens of thousands of employees worldwide, and about 10,000 of them are located in the United States. Their vice-president of information systems believed that Lotus Notes was such a powerful technology that it would sell itself, that the main thing to do was to rapidly roll it out to the consulting staff, and let them use it to find

creative ways to share information.

He was concerned that his firm employed thousands of "line consultants" in different offices all over North America, who work on similar problems and who rarely share their expertise. Sometimes a consulting team in Boston is dealing with the same kind of issue that a consulting team in Toronto or San Francisco would be dealing with, or very close. They had no easy way of sharing their growing understanding of the problems they were facing with their clients. Could the firm's line consultants use some kind of communication and computerized information system to store what they knew, and share it?

The first test was with the information technology staff. They tended to use Notes; they found it interesting; and they used it fairly aggressively for sharing information about their own projects. Price-Waterhouse's tax consultants in Washington, D.C., were another group that used Lotus Notes (Mehler, 1992). These tax consultants studied the behavior of the Internal Revenue Service and the U.S. Congress, and disseminated tax advisories to Price Waterhouse offices around the country about shifting changes in tax legislation that might affect their clients. These tax consultants made substantial use of Lotus Notes to broadcast their tax advisories.

The line consultants were supposed to become Lotus Notes' primary users. The Vice President of Information Technology felt that Notes was so revolutionary that people didn't even have to be shown how to use it; examples could even stunt their imaginations. The consultants should simply be given an opportunity to use it, and they would learn how to use it in creative ways. Orlikowski (Orlikowski 1993) found that the senior line consultants, who were partners in the firm, tended to be modest users[2] . The more numerous junior line consultants, called associates, were low 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 in an organization having different practices in working with Notes. How can we explain such differences?

One explanation focuses upon the incentive systems in the firm. A good place to start our analysis is with the associate consultants and the partners. Price Waterhouse -- and many other large consulting firms in North America -- reviews its consultants through a demanding promotion system. The associates are reviewed every two years, for "up or out" promotions. In the first few rounds at major firms, about half of the associates are fired at each review. In their "up or out" system, the many associate consultants' goals are to be promoted to the status of partner. Consultants who are promoted to the status of partners can expect annual incomes over $300,000 at these major firms. Partnerships are the golden ring that these firms use to motivate their associate consultants.

The associates are valued for their billable hours, and were 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 they have an account that they can charge their time to. Lotus Notes, the revolutionary technology, was not provided to them with a "training account" to bill their time to. 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 billed 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 (but which could be revolutionary). 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 a major question about what would the consultants actually do with Notes after they learned how to use it. Consequently, relatively few associates saw value in Notes; there were no exemplary demonstrations showing them how other successful line consultants used Notes.

On the other hand, the partners had substantial job security (which was 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. 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, generally, younger consultants had less incentive to learn Notes than did the middle-aged and elderly partners.

But what about the information technology staff and the tax consultants? These groups had a certain advantage in their forms of job security. Many of the information technology staff were technophiles who were willing to work with an interesting new application. Lotus Notes has been helpful for people who can invest time in learning how to use it, especially when they have joint projects and major motivations for communicating, for documenting work, for sharing memos, and so on.

The tax consultants, who were located in Washington, D.C., had a significant incentive to show that they were visible and valuable in the firm. In their case, salary didn't give them an incentive, it gave them protection. 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, organizational incentive systems were not part of the original marketing story of Lotus Notes. The interesting information processing features enabled by Lotus Notes were emphasized in numerous stories in the technical press and (See, for example, Kirkpatrick, 1993.)

An organization, or organizational sub-units with different incentive systems,

might use Notes very differently. The way that some consultants in Ernst and Young (E&Y), another major consulting firm, use Notes is instructive (Davenport, 1997; Gierkink and Ruggles, n.d.). In brief, E&Y created an organization (Center for Business Knowledge) whose charter was to organize E&Y's consultants' know-how in specific high profile areas. By 1997, E&Y had developed 22 distinct social cross-office networks of consultants with expertise in certain industries, organizational reforms, or technologies that were a focus of E&Y's business.

Each network was assigned a half-time person to codify in Notes databases the insights from specific consulting projects, to prompt line consultants to add their own insights, and to edit and prune a project's discussion and document databases. In some cases, they were charged to develop topical "Power Packs" in Notes -- a structured and filtered set of online materials including sales presentations and proposal templates. Davenport observed that these "knowledge networkers" understood their network's domains and that these were short term assignments for line consultants.

In this case, E&Y designed a human organizational "intelligence system" for sharing insights, ideas, and materials in specific topical areas. Lotus Notes served as an information support system -- a medium for storing, organizing and communicating these materials.

Taken together, these cases illustrate varied consequences of Notes' use in large consulting firms, not one fixed effect. Varied, conflicting consequences in different settings is common in this body of research. Our job as researchers is not simply to document the various consequences of computerization, but also to theorize them (see Lamb, 1996; Robey, 1997). Different organizational incentive systems for different professionals is one way to conceptualize a key concept that helps to integrate some of these seemingly disparate cases. (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.) It is possible that the way that Notes is used at both Price Waterhouse (now merged with Coopers-Lybrand) and E&Y have changed since the studies that inform this article were written. Our point here is not to praise E&Y and to criticize Price Waterhouse. Rather, it is to understand how their behavior can help us develop empirically-grounded concepts that help us to predict (or at least understand) variations in the ways that people and groups use information technologies.

One key idea of social informatics research is that the "social context" of information technology 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 information technology; it refers to a specific matrix of social relationships. Here, social context is characterized by particular

incentive systems for using, organizing, and sharing information at work. In the cases described above, different groups within Price Waterhouse and E&Y have different incentives to share information about the project know-how, and, thus, how they use or avoid Lotus Notes.

The case of E&Y also illustrates an important idea -- that of conceptualizing the design of computer and networked systems as a set of interrelated decisions about technology and the organization of work. Unfortunately, thinking and talking about computerization as the development of socio-technical configurations, rather than as simply installing and using a new technology, is not commonplace. It is common for managers and technologists to discuss some social repercussions of new technologies, such as the sponsorship of projects, training people to use new systems, and controls over access to information. However, these discussions usually treat all or most social behavior as separable from the technologies, whereas the E&Y case suggests how a more integrated socio-technical view is critical. We will amplify this key idea with additional examples.

5.2 Work Processes Matters With Documentary Systems

The social informatics approaches have been applied to some issues that are of particular concern to designers of digital libraries -- working with documentary systems. How do people work with documentary systems in practice? We know that certain visions did not come about, such as the early 1980s vision of the paperless office. It is intriguing to speculate why one of the hot items in a "paperless office" is a laser printer. Why are laser printer sales rising steadily -- and faster ones, more colorful ones -- if the direction of development is to abandon paper? There is a conceptual disconnect here. It is not because people like paper in the same way that people have an affection for dogs or cats. It is not a sentimental attachment. Laser printers are not popular because people enjoy the look and feel of typical 8-1/2" x 11", 20 pound bond.

Some people do like the hand-feel of richly textured paper. *Wired Magazine*, at least, is printed in vivid colors. It is visually engaging, although some people are put off by its intensely-colored pages. People at times like books and other documents which are printed on nicely textured paper. We should not ignore the sensual qualities of some high quality papers. But standard 20 pound printer and copier papers are not designed for sensuality.

Careful studies of professional and clerical documentary work find that many people engage in complex activities -- such as annotating documents; comparing them, for instance, as an editor compares two versions of a paper or a book chapter to see what the changes were; or integrating them, for instance in assembling a long report (see Suchman, 1996). The screen space of the more common 14-, 15-, or even 17-inch displays are too limited. To compare two full-page manuscripts, it helps to put them side by side. That would require about 24 inches of display. Today, 24-inch displays, priced at about $1500, are

too costly for most offices. While the costs and overall mass of large-screen monitors will decline in the next decade, paper has other virtues. Many people who work with multiple documents, mark them up with quick annotations and diagrams that are more clumsy with word processors and take them to different places; paper is simple and versatile.

For certain transaction systems, such as airline reservation systems, the move to paperless transactions has been workable -- because it reduces operational costs in re-issuing new tickets and people make few additional notations on their tickets. In contrast, people who are doing analytical work with manuscripts have found paper to be an extremely durable and useful medium, for a variety of reasons. Some of the value of paper is based on the work of comparing and working with documents side by side. It is partly a real estate issue, and partly a portability issue -- documents can be moved around an office or taken off-site quickly and easily without having to have a running device.

Paper plays important roles in some places where we don't think it is in use. An interesting example is in civilian air traffic control systems. The movie version of air traffic controllers shows them staring at bright green displays. In real-life they do depend upon computer displays. But they also keep track of the planes that they are monitoring on little pieces of paper a little bigger than that of fortune cookies, which record flights, flight vectors, and speed, among other things. Because they divide their work by air space, when the plane moves from one scope to the next, they pass the paper over. Gary Stix (1994) examines (a) the nature of the work and communication via paper strips, and (b) IBM's efforts in 1993 to automate it. Stix reports that IBM had a database with 65 fields -- a little complicated for real time control! That project has since been abandoned by the FAA in the United States at a cost of several hundreds of millions dollars. But the FAA will continue to develop upgrades, because the computers on which the air traffic control system runs are aging, and it is hard to get spare parts, technicians, and so on.

This "work-oriented view" of how people work and use computer systems in practice is not always inspiring. Many people work hard, and they do many interesting things, but their work with information technologies is not streamlined. Professionals, for example, often work across media, across technologies, and across social boundaries in ways that new, computer-based systems don't readily integrate. Their workspaces can appear messy and their workflow cumbersome, even when they have good computer systems to help with part of their work. Social informatics is one sustained way of understanding these issues in ways that do help improve the workability and design of systems and information services for various workers and the public.

5.3 Socio-technical Systems and Electronic Journals

The use of the Internet to support scientific communication is one of the major shifts in the practice of science in this era and it has generated numerous

experiments and significant discussion. In the scientific communities, these communications include informal e-mail, the communication of conference programs as they gel, the sharing of preprints, access to electronic versions of journal articles, and the development of shared disciplinary corpuses. These communicative practices are becoming more important in many fields, although they are rarely the central communications media. However, only a few analyses take sufficient account of the ways in which the social dimensions of publications, such as the design of electronic journals, influence their use (see, for example, Kling and Covi, 1995).

One common approach to conceptualizing new forms such as electronic journals, on-line newspapers, electronic forums, Web sites and digital libraries emphasizes their technologically-based information-processing features, such as enabling authors and readers to communicate more directly without the mediation of libraries or expensive publishers. The socio-technical approach, explained below, views these new forms as mixing together both technological elements and social relationships into an effectively inseparable ensemble.

From a technological information processing perspective, new media such as electronic journals[3], databases, preprint servers -- are said to reduce the costs of communication, expand the range of people and locations from which materials are accessible, and generally speed communications. According to this view, as scholars in all scientific fields work with data, and communicate both formally and informally with other scholars, all of these electronic media forums should be adopted and used fairly uniformly. Differences in value would rest upon the differences in technical architectures. For example, readers would be more likely to read electronic journal A rather than journal B if journal A added more informational value, such as having an elaborate set of cross links between articles, or including more extensive sets of data and graphics.

Even the strongest proponents of electronic journals agree that technological design alone is not sufficient to insure a good quality journal. There is a strong consensus that the quality of a journal's scholarly content is important in making it viable, but there is substantial disagreement about the means of attracting high quality materials. All the proposals and counter proposals for attracting high quality authors rest on social analyses of a journal, rather than purely technological analyses. For example, one aspect electronic journals that is commonly discussed is the role of peer review[4]. There are many ways of organizing peer reviews, but each strategy for selecting reviewers and translating their assessments into feedback for authors and publication criteria for the journal is a social process. These social processes are supported by communication media, and electronic media may facilitate or inhibit specific ways of organizing reviewers, reviewing and editing.

The value of a socio-technical analysis can be illustrated by contrasting the design and functioning of two different electronic journals: the *Electronic Transactions of Artificial Intelligence* and *The Electronic Journal of Cognitive*

and Brain Sciences. Superficially, these scientific electronic journals have much in common: each is hosted on a Web site, relies upon peer review to select high quality articles, and posts articles for public pre-review before they are accepted or rejected for formal publication. Both journals were established in 1997 and have had about 18 months of activity to establish a publishing pattern. These two journals are especially interesting in the ways that their designers envision attracting authors to submit high quality articles, and to insure that only high quality articles are actually published.

However, one of these journals seems to be viable and one seems moribund. The technological publication system for each journal functions effectively, and I will indicate how the differences rest on their design as socio-technical systems. Rather than analyze the journals as I describe them, I believe that it would be useful for readers to note the contrasts in the two journals' designs, and to try to evaluate which journal is the more viable and why.

Electronic Transactions on Artificial Intelligence (*ETAI*):

The ECCAI (European Coordinating Committee for Artificial Intelligence) announced the *ETAI* as a journal in May 1997, with Professor Erik Sandewall, a pioneer of artificial intelligence research in Scandinavia, as its Editor-in-Chief. The journal's editors and organizers sought to make the review process of articles more open for authors and readers, by making some aspects of an article's review very public. *ETAI's* editors claim:

"The *ETAI* represents a novel approach to electronic publishing. We do not simply inherit the patterns from the older technology, but instead we have rethought the structure of scientific communication in order to make the best possible use of international computer networks as well as electronic document and database technologies."

They describe their editorial process as follows:

"Articles submitted to the *ETAI* are reviewed in a 2-phase process. After submission, an article is open to public online discussion in the area's News Journal [part of the journal's Web site]. After the discussion period of three months, and after the authors have had a chance to revise it, the article is reviewed for acceptance by the *ETAI*, using confidential peer review and journal level quality criteria. This second phase is expected to be rather short because of the preceding discussion and possible revision. During the entire reviewing process, the article is already published in a "First Publication Archive", which compares to publication as a departmental tech report." (From *ETAI*, 1997; see Sandewall, 1998 for a more elaborate description of their editorial process.)

The *ETAI* is divided into several topical sections, each section with its own section editor. The *ETAI* Web site has a public discussion section linked to each submitted article. An annual paper edition of the articles, without the

discussion, is published by the Royal Swedish Academy of Sciences (KVA).

The Electronic Journal of Cognitive and Brain Sciences (*EJCBS*)

The *EJCBS* was devised by Dr. Zoltan Nadasdy of Rutgers University as an e-journal "that works without editors" and which offers the following features (Nadasdy, 1998a)[5]:

"Instead of a hidebound peer-review system, we use an interactive "vote," in which those with comments and suggestions post them along with the article.

"Instead of a lengthy discussion carried out over a period of months and years as letters are submitted to journals and await publication, we allow anyone to post letters, and allow authors to answer them immediately.

"Instead of layout designers, we make use of...automated-formatting software that converts simple ASCII documents into HTML. The system supports graphical illustrations and automatically inserts them into the text. Hypertext is also inserted into the articles."

Nadasdy sought to devise "an autonomous system" that could run on its own after it was programmed. It would rely upon readers to be referees, and not rely upon an editorial board. He designed it with the aim "that [it] would be able to control itself based on reasonable rules". He developed software to automatically create a Web page with graphics for each submitted article, so that no human editorial activity would be required to post articles.

"*EJCBS* uses a two-tier acceptance procedure that makes reviewing automatic and allows readers to control final acceptance: review status and archive status. Papers in review status are evaluated by the readers...a weight system controls the score given by different reader categories. The scores are transferred to a database that will be averaged at the end of a month, and the final status of the paper will be decided accordingly. Articles that receive a certain average score, or higher, are transferred to an archive of accepted papers. Those papers that do not receive the minimal average scores are rejected."

Nadasdy designed *EJCBS* to improve the speed of publication, be low cost, enhance interactivity, and enable broad distribution. He claims that "those features are all integrated into the system I call "interactive publishing." The impact of interactive publishing could be enormous. It redefines concepts of traditional publishing, such as editing, acceptance, reviews and comments, and archives."

The reviewing practices of *EJCBS* and *ETAI* differ considerably. *EJCBS* relies on anonymous reviewing by (self-selected) readers. They visit its Web site and rate an article on several seven-point scales to indicate their views of its quality and importance. Nadasdy hoped that *EJCBS* could "run itself" and has tried to automate key editorial processes. It is an extreme example of removing editorial attention and guidance from the publishing process and relying upon a

readers' plebiscite.

In contrast, an article that is submitted to *ETAI*, is a topic for public discussion by participants in the research community. During the three month open review period, questions and comments are signed. In an informal reading of the discussion about several articles, I found that only a few questions were typically posted. However, they reflected a deep understanding of the topics, and some were elaborate counter-examples or reformulations of the authors' positions. Authors' replies were also public, and seemed to engage the technical issues raised in the queries.

Both *ETAI* and *EJCBS* were initiated in 1997. The *ETAI* accepted five articles for publication in 1997 while *EJCBS* posted two short articles in September 1997, but has not accepted any. The *ETAI* continues to receive a steady stream of submissions (eight articles in 1998) while the *EJCBS* does not[6]. The contrast between the *ETAI* and the *EJCBS* offers and interesting illustration of a (simplified) socio-technical systems analysis.

5.3.1 Socio-technical Systems

Social informatics research has produced some useful ideas and findings that are applicable to many kinds of information technologies and shed interesting light on these dilemmas of Internet use. The concept of "computerized information systems as social technical systems" is one such idea that helps us understand the character of e-journals, as well as other e-media.

Information and communication technologies are often discussed as tools or simple appliances, even when they refer to complex arrangements of varied equipment, rules/roles/resources, and actual organizational practices, as with WWW sites or airline reservation systems. It is more interesting to view specific information technologies as "socio-technical systems"[7] -- a complex, interdependent system comprised of:

- people in various roles and relationships with each other and with other system elements;
- hardware (computer mainframes, workstations, peripherals, telecommunications equipment);
- software (operating systems, utilities and application programs);
- techniques (management science models, voting schemes);
- support resources (training/support/help); and
- information structures (content and content providers, rules/norms/regulations, such as those that authorize people to use systems and information in specific ways, access controls).

These elements are not simply a static list, but are interrelated within a matrix of social and technical dependencies[8].

A systems designer with a socio-technical orientation does not simply consider these elements while working in a "design studio" far away from the people who will use a specific system. Effectively designing socio-technical systems also requires upon a set of "discovery processes" to help the designers understand which features and tradeoffs will most appeal to the people who are most likely to use the system[9]. There are a number of discovery processes for learning about the preferences of the men and women who are likely to use these systems. These discovery processes include workplace ethnography (Simonsen and Kensing, 1997), focus groups, user participation in design teams (Bolstrom and Heinen, 1977b; Carmel, Whittaker and George, 1993), and participatory design strategies (Schuler and Namioka, 1993; Eckehard, et al. 1997). These approaches differ in many significant ways, such as the contextual richness of the understandings that they reveal and the extent to which they give the people who will use systems influence and power in their design. These issues are the subject of a lively body of research that overlaps social informatics. However, to discuss it in detail here would lead us away from our focus on the structural elements of a socio-technical analysis.

For our post-hoc analytical purposes, we can focus on the structural features of the socio-technical system that we have listed above. We view the design of *ETAI* and *EJCBS* not simply as one of artifacts, such as the compilers that Nadasdy developed to automatically translate submitted article files into postable WWW pages for *EJCBS*. Rather, the interplay of social assumptions and practices that are reflected in technological design features helps us to understand the relative success of these two e-journals.

In the case of *ETAI*, authors link up with potential readers through the journal's published articles. However, in order to have an article published, an author must be willing to discuss it in a public forum with other self-identified artificial intelligence (AI) researchers. This arrangement adds an important social and discursive element to publishing in the journal: authors must be willing to participate in this part of the AI community by discussing their research. Publication in *ETAI* entails a set of relatively public social actions. Further, the editorial board of the *ETAI* was developed to include senior members European Coordinating Committee for Artificial Intelligence and paper publication through the Royal Swedish Academy of Sciences. Potential authors have good reason to believe that their articles will be known to participants in the European AI research community. According to Erik Sandewall, this visibility is a mixed blessing: it can enhance one's status for work that is well received, but also can be embarrassing for authors whose work is ill-conceived, not well developed, or is not well received.

The *EJCBS* looks more problematic as a socio-technical system. An author who submits an article will receive votes and possible comments from anonymous readers, but does not have a forum in which to respond or to develop a discussion with the readers. While the *ETAI* has an editorial board whose

members participate in a variety of high status scientific social networks and promote the journal, the *EJCBS* was designed by one relatively low status and not well connected bio-scientist who would like to have it work without promotional or editorial attention -- autonomously. Authors who publish in *EJCBS* are not guaranteed any attention among highly active scientists in their field.

Nadasdy (1998b) believes that he has "shown that the (journal) concept works, and that people just have to come around to use it." His comment reflects a technologically focussed view of e-publishing, one which pays much more attention to automating scripts and voting procedures than in seeking ways to effectively mobilize a lively group of authors and readers around the journal.

I have developed these two examples at some length because they help us to see how a socio-technical perspective on e-journals helps us to better understand how they may or may not serve as vibrant media for community communication. Nadasdy did "market the journal" by encouraging about 100 senior scientists to publish their articles in it. A few of them sent encouraging comments, but none submitted their research articles for review and possible publication. Nadasdy's software works; if an e-journal is only a technological artifact, he "has a working journal." However, a genuine "working journal" requires a continuing stream of authors and readers, then the design requires a more sophisticated social-technical approach than Nadasdy has taken on. These ideas extend beyond e-journals, to digital libraries, electronic forums and so on.

It is also possible to revisit the cases of Lotus Notes use in consulting firms to examine their design as socio-technical communication systems within the social networks of the firms. One major difference between Price Waterhouse and E&Y lies in E&Y's creating new social groups with a responsibility for collecting, organizing and disseminating information for which Lotus Notes could be a helpful medium.

Further, the concept of socio-technical systems can help us understand some of the differences between WWW sites and digital libraries that are highly used or little used. As technological systems, they are collections of software, data (text, picture files, etc.), links, and metadata (indices, etc.) that run on networked computers. As socio-technical systems, we can pay special attention to:

- people in various roles and relationships with each other and with other system elements;
- support resources (training/support/help); and
- information structures (content and content providers, rules/norms/regulations, such as those that authorize people to use systems and information in specific ways, access controls).

and ask about the importance of their content for various constituencies, who is authorized to change content and how that matters, etc.

There are many such questions that help us connect technological artifacts in a lively way to a social world. As a design practice, a "socio-technical approach" also requires a discovery process that helps designers to effectively understand the relevant lifeworlds and workworlds of the people who will use their systems.

5.4 Computing Infrastructure and Public Access to Information via the Internet

There are innumerable examples of the use and value of the Internet in providing new kinds of communications to support a cornucopia of human activities in virtually every profession and kind of institution. In the U.S., the professional and middle classes have found the Internet to be useful for communication with some government agencies, for some forms of shopping, for tackling investments, maintaining ties with friends and family via email, and as a source of entertainment.

There are also many examples where the Internet enables the middle class public to have better access to important information (See Kahin and Keller, 1995). In the U.S., the public is beginning to turn to medical sources on the Web, to get alternative answers on the Internet, in discussion groups and so on, and sometimes bypassing the medical establishment.

Some people seek either alternative medical advice or information about issues that their doctors don't deal with very well. Surgeons, for example, may be good at doing very skilled surgery, but they may not be very good for giving people an understanding of what it takes to go through the recovery process. People sometimes find that certain Internet sources can be extremely helpful as either alternatives or supplements. This is simply a hypothesis, but there is anecdotal evidence that the Internet provides an alternative communication means for many middle class people to bypass the medical establishment. Anecdotal evidence suggests that doctors vary in their responses to their patients feeling better informed, and sometimes challenging their advice -- from encouragement to annoyance. What kinds of changes in systematic patient-doctor relationships may result is as yet unclear.

In the United States, Vice-President Al Gore promotes networking for libraries, clinics, and schools, by arguing that if they are wired together, their use will improve public education and enable substantially improved public services. How to actually transform such networks into meaningful social support systems is a question that remains unanswered.

While many people install additional phone lines for online computer use, affordable telephone service and Internet service providers (ISPs) are available in urban areas (Kahin and Keller, 1995). Access to ISPs, and even basic telephone service, is more problematic in many rural areas. In 1995, about 28.8 million people in the United States 16 years and over had access to the Internet

at work, school or home; 16.4 million people used the Internet and 11.5 million people of these people used the Web. About 80 per cent of these people used the Internet at least once a week. However, about 182 million people 16 years and over did not have access to the Internet (Hoffman, Kalsbeek, and Novak, 1996). A 1997 nation-wide household study found that computer ownership and e-mail access were rising rapidly -- about 94% of households have telephones, 37% have personal computers; 26% have modems, and 19% have on-line access (McConnaughey and Lader. 1998). The numbers of people with Internet access continues to rise rapidly.

It might appear that technological access is the primary roadblock to expanded Internet use. "Technological access" refers to the physical availability of suitable equipment, including computers of adequate speed and equipped with appropriate software for a given activity. Scenarios of "ordinary people" using the Internet often assume that computer support is easy to organize, and that access to information and services is not problematic.

In contrast, "social access" refers to know-how, a mix of professional knowledge economic resources, and technical skills, to use technologies in ways that enhance professional practices and social life. In practice, social access -- the abilities of diverse organizations and people from many walks of life to actually use these services -- will be critical if they are to move from the laboratories and pilot projects into widespread use where they can vitalize the nation and the economy. Social access should not be viewed as an "add on" to a technological structure. Many systems designers have learned, for example, that a well designed systems does not simply tack on a "computer interface" after its internal structure has been set in place. The design of human interfaces and internal structures is highly coupled for systems that effectively support people's work and communication (see National Research Council, 1997 for an integrated review). In a similar way, social access is integral to the design and development of systems and services that are to be widely used.

Some analysts do not view social access to the Internet for "ordinary people" as problematic, since they believe that access costs will rapidly decline and the public's computing skills will continue to rise. In this view, time and markets will resolve most access issues. In contrast, we believe that social access to the Internet is likely to prove vexing for many people, based on what careful studies of computer use and Internet use have shown us.

Although 50% of US households may have computers by the year 2000, organizations have been the major sites for adopting networked information systems, especially as implementers of advanced technologies. There are few studies of computer use in households. In one careful study of "ordinary households" (HomeNet), researchers found that using the Internet is too hard for many "ordinary people" (Kiesler, Kraut, Mukhopadhyay, and Scherlis. 1997):

"Over 70% of the households called the help desk. Calls to the help desk represented the behavior of some of the more sophisticated users. Less sophisticated users dropped out once they hit usability barriers. The kinds of problems logged by help desk staff included problems in installing phone service, configuring the telecommunication software, busy signals (users often blamed themselves!), buggy software, inexperience with mice, keyboards, scroll bars, terminology, radio buttons, and menus. Yet, in our home interviews, we noted there were many more problems participants had not called about.

".. we thought that as everyone learned how to use the computer and what the Internet could do for them, the influence of their initial computer skill would decline with time. We were wrong. Even after a year of experience with the Internet, participant's initial computer skill still constrained their Internet usage. This result held across different gender and age groups."

These findings serve as a cautionary note about our expecting the North American public to rapidly form a "network nation." One intriguing finding of the HomeNet project is that families with adolescents made much more use of the Internet than those without. We suspect that many of these teenagers became critical "on-site" technical consultants for their parents.

5.4.1 Infrastructure for Computing Support is Social as Well as Technological

PCs are much more complicated to install and use for a diverse array of tasks than are "turnkey appliances" such as televisions and VCRs. While it is a standing joke that most people don't know how to program their VCRs (and thus watch an LCD blinking 00:00), most people can reliably play a videotape and enjoy the resulting entertainment. In contrast, PCs that use networked services require much more complex configurations (including data rates and IP numbers) that can change with changes in network configurations and service providers.

Effective computer systems that use Internet services will require reliable complementary technological resources -- such as printers, electricity (reliable in urban settings, sometimes problematic after disasters and in remote regions). What is less well appreciated is how the infrastructure for making computer systems workable also includes a variety of resources that are social in character. Skilled technical installers, trainers and consultants are the most obvious social resources. In addition, people who use advanced networking applications need know-how -- to be able to learn to effectively integrate them into their working practices -- based on learning from others.

There is some debate about how much computer use has simplified in the last decade. It is probably easier to use a stand-alone PC "out of the box." However, the dominant operating systems, such as Windows 95/98/NT, Unix (and Linux)

can still stump experts when applications or components interact badly.

System infrastructure is a socio-technical system since technical capabilities depend upon skilled people, administrative procedures, etc.; and social capabilities are enabled by simpler supporting technologies (e.g., word processors for creating technical documents, cellular telephones and pagers for contacting rapid-response consultants) (Kling, 1992). Malfunctioning computer systems are not simply an opportunity loss, such as a book that is bought but not read. When people organize their days about the expectations that key technologies will work well -- and they don't -- they often spend considerable time tinkering to get systems to work, waiting for help to come, and so on.

Workable computer applications are usually supported by a strong socio-technical infrastructure. The "surface features" of computer systems are the most visible and the primary subject of debates and systems analysis. But they are only one part of computerization projects. Many key parts of information systems are neither immediately visible or interesting in their novelty. They include technical infrastructure, such as reliable electricity (which may be a given in urban America, but problematic in wilderness areas, or in urban areas after a major devastation.) They also involve a range of skilled-support -- from people to document systems features and train people to use them to rapid-response consultants who can diagnose and repair system failures

Much of the research about appropriate infrastructure comes from studies of systems that underperformed or failed (Star and Ruhleder, 1996; Kling and Scacchi,1982). The social infrastructure for a given computer system is not homogeneous across social sites. For example, the Worm Community System was a collaboratory for molecular biologists who worked in hundreds of university laboratories; key social infrastructure for network connectivity and (UNIX) skills depended upon the laboratory's work organization (and local university resources) (See Star and Ruhleder, 1996). Researchers found that the Worm Community System was technically well designed; but it was rather weak as an effective collaboratory because of the uneven and often limited support for its technical requirements in various university labs. In short, a weak local socio-technical infrastructure can undermine the effective workability of computer systems, including those in people’s homes, as we have discussed above (also see Haddon and Silverstone, 1995).

6.0 Why Social Informatics Matters

Social informatics research pertains to information technology use and social change in any sort of social setting, not just organizations. Social informatics researchers are specially interested in developing reliable knowledge about information technology and social change, based on systematic empirical research, to inform both public policy debates and professional practice. Many

of us have developed concepts to help understand the design, use, configuration, and/or consequences of information and communication technologies so that they are actually workable for people. This contrasts with high spirited but largely a-priori promotions of technologies that occasionally work well for people, occasionally are valuable, are sometimes abandoned, are sometimes unusable, and thus incur predictable waste and inspire misplaced hopes. That is one important way that "social informatics matters" and one that I have emphasized in this article. This view of social informatics has important repercussions for public policy, professional practice, and the education of information technology professionals (see Kling, 1993; Kling and Allen, 1996; Kling, Crawford, Rosenbaum, Sawyer, and Weisband, 1999).

Social informatics research also investigates intriguing new social phenomena that emerge when people use information technology, such as the ways that people develop trust in virtual teams (Iacono and Weisband, 1997) or the ways that disciplinary norms influence scholars use of electronic communication media (Kling and McKim, in press). But these phenomena would be the focus of another article.

In this article I have identified a few key ideas that come from 25 years of systematic analytical and critical research about information technology and social life. There are other sources for a more expanded treatment (see, for example Kling, 1993; Kling and Allen, 1996; Bishop and Star, 1996; Kling and Star, 1998; Kling, Crawford, Rosenbaum, Sawyer, and Weisband, 1999).

Other social informatics researchers might emphasize other ideas. I have emphasized organizational examples because information technology and organizational change (organizational informatics) have been more carefully researched and theorized in complex organizations than computer use in settings such as households.

7.0 Social Informatics as a Field Name

Social informatics is a neologism. I have written enthusiastically about social informatics, but many people are appropriately cautious about catchy new terms whose connotations can mislead. The label "social informatics" emerged from discussions in 1996 within the community of researchers who conduct the kind of research discussed in this article. Several social informatics researchers participated in a workshop at UCLA on social aspects of digital libraries in 1996 (see http://dlis.gseis.ucla.edu/DL/). In the course of discussing research about digital libraries and computer supported cooperative work (CSCW), we realized that we did not have a good label for the body of research that we now call social informatics. We used various labels, including "social analysis of computing," "social impacts of computing," "information systems research," and "behavioral information systems research."

Several of us felt that it was time to help make this body of ongoing research much more accessible by finding one name that could serve as an efficient pointer, and a banner. Instead of being skeptical of new nomenclature, we should be willing to find a field name that we could use. A number of us discussed alternatives such as "social analysis of computing," "interpretive informatics," "socio-technical systems" -- and the term "social informatics" came up as the least offensive alternative of the group. For some people it inspired curiosity; for others, it simply was not a turn-off, whereas for some, "interpretive informatics" tended not to cross cultural lines.

The social informatics label energizes some faculty. One colleague at another university told me that he didn't know how to succinctly characterize his interests when he was searching for a professorship. When he learned about social informatics, he felt that it was a terrific label for his interests. But I also know some faculty, especially those who are in single-discipline academic units, whose research comfortably fits within social informatics who will resist the term because adopting it doesn't help them in their struggles for research resources, good students, and impact for their research within their traditionally defined disciplines.

There are a number of journals which publish social informatics research. A comprehensive list would be lengthy; but most of the journals listed would be ones that have published only a few social informatics articles. There are a few journals that are good sources of social informatics research, including *The Information Society* and some journals in the information systems field, such as *Information Systems Research*. Social informatics studies appear in communication journals such as the *Journal of Communication* as well as in the electronic *Journal of Computer-Mediated Communication*. The *Journal of the American Society of Information Science* published a special issue in October 1998 devoted to social informatics (Kling, Rosenbaum and Hert, 1998). The *Communications of the ACM*, a magazine, also publishes articles that are based on social informatics research. There are numerous books (see Dutton, 1997; Huff and Finholt (1994); Kling, 1996; Kiesler, 1997; Smith and Kollock, 1998; and DeSanctis and Fulk (in press) as entry points). The research is conducted in several different disciplines, especially in some social sciences, information science, computer science and information systems.

The National Science Foundation sponsored a workshop on Advances in Organizational and Social Informatics in the Fall of 1997 to help to further develop the field (see http://memex.lib.indiana.edu/siwkshop/SocInfo1.html). The workshop's participants characterized social informatics as: "the interdisciplinary study of the design, uses and consequences of information and communication technologies that takes into account their interaction with institutional and cultural contexts."

This characterization sets some boundaries as well as articulating a focus for social informatics. For example, simple surveys of the number of people who

use the Internet for specific purposes that did not examine these uses in institutional and cultural contexts would not be a social informatics study. However, such survey data could be useful as part of a social informatics analysis.

In addition, the workshop participants characterized social informatics research as analytical, critical or normative. The *analytical orientation* refers to studies that develop theories about information technologies in institutional and cultural contexts or to empirical studies that are organized to contribute to such theorizing. I have emphasized analytical research in this short article. The *critical orientation* refers to examining information technologies from perspectives that do not automatically and "uncritically" adopt the goals and beliefs of the groups that commission, design, or implement specific information technologies.

Our discussion of the use of Lotus Notes in light of organizational incentive structures illustrates the analytical orientation in social informatics. The critical orientation is possibly the most novel (Agre and Schuler, 1997). It encourages professionals and researchers to examine information technologies from multiple perspectives (such as the various people who use them in different contexts, as well as people who design, implement or maintain them), and to examine possible "failure modes" and service losses, as well as ideal or routine ICT operations. This article illustrates a critical perspective in the examination of Lotus Notes' use, the design of electronic journals, and public access to the Internet.

A book based on this workshop examines the character of the field, some of the key ideas, and teaching issues (Kling, Crawford, Rosenbaum, Sawyer and Weisband, 1999). It also includes discussions of ways to develop the field, communicate key ideas of social informatics to relevant scholarly and professional communities, and to enrich the curricula for computing-oriented students.

Social informatics has a Web page at http://www.slis.indiana.edu/SI and a small collection of on-line discussion forums. The WWW page includes sections that list and link courses, research conferences, degree programs, and so on. There are many opportunities to conduct research in social informatics, to translate research ideas into professional practice or to teach. I invite you to join us in a lively adventure.

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