EXECUTIVE OVERVIEW

TECHNOLOGY AND INSTITUTIONS: WHAT CAN RESEARCH ON INFORMATION TECHNOLOGY AND RESEARCH ON ORGANIZATIONS LEARN FROM EACH OTHER?

Wanda J. Orlikowski and Stephen R. Barley   **Page 145**

Since its early beginnings as an academic field, Information Systems (IS) has liberally borrowed from the so-called "reference disciplines." Organization science, management science, computer science, and economics are the disciplines that IS researchers have most frequently consulted when designing their own research. By most accounts, the borrowing has provided a strong theoretical base for our applied studies of the design, development, implementation, use, and consequences of information technologies in organizations. However, many in IS worry that we have contributed little to other fields, leaving IS as a "derivative" field that is only equipped to apply ideas drawn from more established scientific fields.

Wanda Orlikowski and Steve Barley acknowledge IS's debts to organization science, but they suggest interesting ways in which the debts can be repaid. Specifically, organization science can learn from IS's focus on specific, material properties of information technology. Rather than conceptualizing technology as an abstract cause or condition for organizational response, technology can be understood in terms of its material properties, affordances and constraints. Such a contribution would sharpen arguments in organization studies by specifying how information technology enabled or constrained organizational action. By the same token, Orlikowski and Barley suggest that IS continue to borrow from organization science. Specifically, they identify institutional theory as a relatively unexploited body of work that positions issues related to technology adoption and use within a broader social context.

Orlikowski and Barley then demonstrate the potential value of a fusion between IS and institutional theory by examining the phenomenon of telecommuting. They argue that research should combine an analysis of technology's material characteristics with an analysis of institutional forces promoting and inhibiting new forms of work. Findings would potentially resolve the discrepancy between accounts of telecommuting's practical advantages and empirical evidence that telecommuting's potential is mostly unrealized.

To help frame their arguments, Orlikowski and Barley dismiss the assumption that organization studies and IS are distinct fields. Indeed, the synergies from combining the intellectual and material resources of these fields have been apparent for many years. Thus, there are strong reasons why the "commerce" between the two fields should continue. Orlikowski and Barley offer the example of the research community known as CSCW (computer-supported collaborative work), which has achieved significant insight by fusing contributions from a variety

of social and technical fields of study (anthropology, computer science, social cognition, and others). By fusing with institutional theory, IS could achieve comparable insight.

Although directed primarily toward researchers, this article reminds IS executives and professionals about the importance of considering technical and social aspects of IS together. Just as researchers are urged to be more eclectic and creative in explaining empirical observations, practitioners are also urged to integrate technological and organizational perspectives when solving their own problems.

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Technology and Institutions: What Can Research on Information Technology and Research on Organizations Learn from Each Other?[1]

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Abstract

We argue that because of important epistemological differences between the fields of information technology and organization studies, much can be gained from greater interaction between them. In particular, we argue that information technology research can benefit from incorporating institutional analysis from organization studies, while organization studies can benefit even more by following the lead of information technology research in taking the material properties of technologies into account. We further suggest that the transformations currently occurring in the nature of work and organizing cannot be understood without considering both the technological changes and the institutional contexts that are reshaping economic and organizational activity. Thus, greater interaction between the fields of information technology and organization studies should be viewed as more than a matter of enrichment. In the intellectual engagement of these two fields lies the potential for an important fusion of perspectives, a fusion more carefully attuned to explaining the nature and consequences of the techno-social phenomena that increasingly pervade our lives.

Keywords: Epistemology, institutional analysis, information technology, organization studies, research agenda, technological change

ISRL Categories: AE, AI08, D01, BD02, DA03, DD01, IB

Introduction

As the 21st century dawns, there is a growing consensus that micro-electronically based information technologies are altering the way we live, work, communicate, and organize our activities. In fact, many people believe that we have entered a period of socio-economic change that will prove to be as monumental as the industrial revolution. Because organization studies (OS) and information technology (IT) are disciplines dedicated respectively to studying the social and technical aspects of organizing, cross-fertilization, if not outright collaboration, between the two would seem to be beneficial—even necessary—for documenting and assessing the changes taking place around us. In the course of this essay, we shall make a case for such a partnership. But to understand how IT and OS might learn from each other, it is important to dispel two faulty assumptions from the start. The first is that information technology and organization studies are distinct fields. The second is that IT and OS have previously had little commerce and, therefore, that both can learn equally from each other.

Although there are important differences between IT and OS (which we shall explore momentarily), the boundary between the two has long been fuzzy. IT and OS are difficult to separate, in part, because many IT researchers were originally trained as organizational scholars and others who were not so trained have been strongly influenced by the organization studies' literature. As a consequence, academic journals in the field of information technology routinely publish papers that draw heavily on ideas and findings that initially appeared in organization studies' journals. One can also find studies of information technology in organizational journals. In fact, OS journals have recently published a number of papers that directly explore the consequences of adopting and using information technologies (Constant et al. 1996; DeSanctis and Poole 1994; Jarvenpaa and Leidner 1999; Mitchell and Zmud 1999; Orlikowski and Yates 1994; Walther 1995). Yet, the flow of influence remains notoriously lopsided. Organization studies has undoubtedly had more influence on the field of information technology than the reverse.

To prove this point, conduct a quick experiment at your own desk. Pick up any copy of an IT journal, say *Information Systems Research* or the *MIS Quarterly*. Choose a random article and examine its references. The odds are that you will find at least one reference to an article published in an organization studies' journal, perhaps the *Administrative Science Quarterly*, the *Academy of Management Journal, Organization Science*, or *Organizational Behavior and Human Performance*. Now, reverse the experiment: pick a paper at random from any issue of the latter journals. Most likely you will find no reference to papers published in IT journals or to books dealing with issues of systems design or IT infrastructures.

This imbalance of influence is reasonable. Because IT research focuses on information systems in organizations, understanding how organizational phenomena affect the development and use of technologies and how technologies shape organizations are central to the field's agenda. For organizational researchers, on the other hand, information technology is a specialized topic far less central than understanding such issues as human decision making, group dynamics, and the sources of organizational structure. To the degree that IT can be considered a more applied field than OS, the imbalance is to be expected: Influence in most physical and social sciences runs from more general to more applied disciplines. With respect to subject matter, therefore, IT and OS are best understood as overlapping rather than disjoint fields.

There remain, however, important differences between the two fields, the most crucial of which are epistemological. The agenda of much IT research is to develop systems and understand the consequences of information technology (whether models, techniques, or devices), given specific objectives and conditions of operation. A considerable portion of IT research centers on the design, deployment, and use of artifacts that represent tangible solutions to real-world problems. As such, IT has a great deal in common with engineering, architecture, and other fields of design. As in engineering, the practical question, "What works?" drives much of IT research. Although engineers and designers draw exten-

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sively on general scientific knowledge, their attention and energy is typically focused on addressing problems that are contextually, materially, and temporally bounded. Similarly, the objective of much IT research is to generate situated explanations, develop explicit inventions, and propose particular, practical solutions concerning the role of information technology in contemporary life.

The epistemology of OS research more closely resembles that of a traditional science: to develop and test parsimonious explanations for broad classes of phenomena. The field's primary subject matter is human behavior in and between organizations at individual, group, and inter-organizational levels of analysis. As do other social scientists, students of organizations seek primarily to answer the question, "Why?" They strive for theories of high generality. The objectives of OS research are, therefore, to discover regularities, articulate general principles, and identify causal relationships.

These epistemological differences sometimes lead to a perceived incompatibility between emphasizing the particular versus the general or between pursuing practical versus theoretical agendas. As a result, members of one field sometimes dismiss the other. In reality, however, their differences are complementary, as can be easily seen in the relationship between the physical sciences and engineering. Engineers cannot design devices without understanding the general principles that govern the properties of materials, components, and their interactions. Although often overlooked, physical scientists owe their ability to investigate phenomena to the tools that engineers build. In fact, engineers often bring to light empirical irregularities that stimulate further scientific work (Allen 1977). In other words, even among students of the physical world, there can be no general knowing that is not somehow grounded in particulars and no particular explanation without some general perspective. Particulars are important for theory building, and theory is important for making sense of specifics. This interplay of the local and general, the practical and theoretical, is characteristic of the social sciences as well.

We shall argue that it is because of these epistemological differences, rather than differences in subject matter, that much can be gained from greater interaction between IT and OS. At this point in time, however, organization studies probably stand to gain more from intellectual engagement with IT than IT can gain from organization studies. We take this stance not only because we wish to promote a more symmetric flow of ideas, but because changes are occurring in the nature of work and organizing that cannot be understood without taking into account changes in the technological infrastructure on which economic and organizational activity rests. Bridging the two fields should, however, be viewed as more than a matter of enrichment. In the interaction between IT and OS lies the possibility of an important fusion of perspectives, a fusion more carefully attuned to explaining the nature of techno-social phenomena. To see why this might be the case, consider first what the OS field can learn from IT research and, then, what the IT field can still learn from OS research.

What Organization Studies Can Learn From IT Research ████

Materialism vs. Agency

Organizational studies' long standing interest in developing claims and discovering principles that generalize across situations shapes how organizational theorists have conceptualized and studied technology. Although there is evidence that the situation may be changing, most organizational theories have conceptualized technology abstractly, have treated it deterministically (often as a material cause), and have largely ignored the role of human agency in shaping either the design or the use of technology. Organization studies' difficulties in conceptualizing technology began with contingency theories of technology, the field's first concerted attempt to take technology into account.

Following Joan Woodward's seminal work in 1958, organizational theorists became interested in how technology might influence organizational forms. During the 1960s and 1970s, researchers

devised several theories of the relation between technology and organizational structure, all of which argued that different types of technology were consistently associated with different approaches to organizing (e.g., Gerwin 1979, 1981; Harvey 1968; Hickson et al. 1969; Khandwalla 1974; Perrow 1967). The contingency researchers' agenda was to devise a set of principles about (if not an actual theory of) technology and organization which would hold across all organizations and all technologies.

For this reason, contingency theorists defined technology abstractly in one of two ways. Many equated it with type of production system—in particular, custom, small batch, large batch, and continuous manufacturing (Harvey 1968; Woodward 1958). Others sought a set of broad dimensions or attributes to compare technologies regardless of their purpose or design (Glisson 1978; Mohr 1971; Perrow 1967). Key concepts included "complexity," "predictability," and "analyzability" which researchers usually applied to tasks, which they in turn treated as proxies for technology. In both cases, however, technology was construed as a material determinant of an organization's structure. For instance, a popular argument among contingency theorists was that the more complex and unpredictable the technology, the more likely were organizations to adopt an organic rather than a mechanistic structure. Although John Child (1972) attempted to insert an element of agency into contingency theory by noting that managers influenced the choice of both technology and structure, considerations of agency did not extend to a technology's design or use. Choice was limited to the decision to adopt, and once adopted, technologies presumably worked their effects on organizations just as unambiguously as they did in theories that failed to acknowledge volition.

The legacy of treating technology as a material cause, of abstracting away from the specifics of a design, and of ignoring the role of human agency in the process of technological change extends well beyond early contingency and strategic choice theories. Socio-technical systems theorists, for instance, who initially studied technologies as concrete objects and championed the idea that technical and social systems were reciprocally constitutive (Rice 1963; Trist and Bamforth 1951), gradually abandoned close studies of technology and work practices for more abstract images of technology grounded in systems theory. After the publication of Miller and Rice's *Systems of Organization* in 1967, socio-technical systems theorists increasingly framed technology as a process that required inputs and produced outputs with degrees of variation. Socio-technical depictions of technology came to look very much like the black boxes in the causal diagrams drawn by contingency theorists.

The tendency to reduce technology to an abstract, material cause in the name of generalizability marks more contemporary theories of technology as well, even those whose scope is more circumscribed. Media richness theory is a case in point (Daft and Lengel 1984, 1986). Media richness theory tries to explain individuals' choices of communication media in terms of a medium's properties, for instance, its bandwidth, whether transmission is synchronous or asynchronous, and so on. Although media richness theory—in comparison to contingency theory—represents a significant move toward the concrete and signals a welcome interest in the actual properties of technology, the desire for general explanation renders the theory overly deterministic and undermines its ability to explain people's choices. Organizational cultures, individual and group preferences, a community's work practices, and a medium's symbolic properties play at least as important a role in shaping media choice as do the medium's technical properties (Fulk et al. 1987; Markus 1984; Orlikowski and Yates 1994; Trevino et al. 1987).

In recent years, a number of organizational theorists have become interested in the "social construction of technology," a code phrase for the role of agency in technological change. This development represents a shift away from more abstract and materialistic images of technology's role in organizations to a view of technologies as fundamentally social objects. Social constructionists draw inspiration from the work of a number of sociologists of science who began to study technology in the 1980s (Bijker and Law 1992;

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Bijker and Pinch 1987; MacKenzie and Wajcman 1985). Most organizational researchers identified with this approach seek to explain how the interests and perspectives of individuals and groups shape the design and meaning of technical systems (Fulk 1993; Prasad 1993; Thomas 1994). These researchers, however, have yet to examine how agency shapes the way technologies influence work practices and organizational structures once the technology is deployed and used in organizations.

Although interest in social construction signals an important and welcome change in the way technology is conceptualized, researchers sometimes go too far and reject the notion of material affordances and constraints altogether. Kling (1992, p. 355), for example, is critical of what he calls a "relentless" social constructionism, one that "obsessively deconstructs at the expense of all other forms of analysis." Graham Button (1993), an ethnomethodologist who collaborates extensively with IT designers, has similarly taken social constructionists of technology to task for allowing technology and work practices to "vanish." He writes, for example, of Law's application of actor-network theory to shipbuilding (1993, p. 24):

> What is missing in [Law's] description is an account of the details of the associating, an account of the interactional work, the particular embodied practices of the galley builders, even though it is in those details that the galley as an artifact emerges, or is produced....But in Law's actor-network argument, although we have a description of all the things that went into the galley's production, including the fact of their association, we are given no understanding of what that association consists in the production of the particular object, "the galley". This is because in using the term "association", Law has abandoned the idea of actions in favour of processes....Without an account of those work practices the technology again vanishes in a puff of theoretical zeal.

In short, it seems fair to conclude that whether materialist or constructionist in orientation, organizational theorists' preference for a consistent

epistemology has hindered them from developing theories of technological change that adequately bridge the physical and social.

Bridging the Gulf Between Materialism and Agency

Technologies are simultaneously social and physical artifacts. Consequently, neither a strictly constructionist nor a strictly materialist stance are adequate for studying technologies in the workplace. Elements of both perspectives are required. Every technology reflects human agency in two ways. Because it is always possible to meet engineering requirements with multiple designs, all technologies represent a particular set of choices made by specific designers (Bucciarelli 1994). Some are the result of physical considerations, others reflect the designers' assumptions and images of users, still others reflect traditions of the design community, and yet others reflect taken-for-granted understandings of how the world is organized. Furthermore, because most technologies can be used in multiple ways, users shape the implications of technologies as they integrate them into everyday practice (Orlikowski 2000). Similar technologies can, therefore, be embedded into different social systems in different ways, occasioning different social outcomes (Barley 1986).

At the same time, a technology's material properties influence agency. Every technology constrains and affords use (Norman 1988). Although some constraints and affordances are malleable, others are not—at least not without radically redesigning the technology or undermining its operation. The design of ultrasound equipment that radiologists use for imaging the human body offers an example. Sonography requires that someone rotate a hand-held transducer against a person's body to produce images that are displayed on a video monitor. To capture diagnostically useful data, sonographers must constantly readjust the position of the transducer in response to the images they see. This requires that sonographers interpret anatomical and pathological indices in "real time." For this reason, radiologists cannot practically employ sonographers who do not know how to interpret sonograms unless it

becomes possible to design transducers that can capture diagnostically useful data without repositioning—designs that the physical properties of sound waves bouncing off internal organs presently preclude. Thus, the material properties of contemporary ultrasound not only make it infeasible for radiology departments to routinize sonography as they have radiography and fluoroscopy (Barley 1990), but the material properties of the technology constrain the options available to the technology's designers.

The history of research on whether numerically controlled (NC) machine tools deskill machinists illustrates why adequate accounts of the implications of technological change must attend to both human agency and the physical properties of technology. In *Labor and Monopoly Capitalism*, Braverman (1973) argued that technologies deskill workers because, all else being equal, managers choose designs and labor processes that separate cognition from execution and then relegate the latter to workers while reserving the former for managers and staff. Braverman illustrated his thesis by exploring how NC altered the skills and autonomy of machinists. He contended that NC allowed programmers to assume responsibility for the conceptual aspects of machining, which forced skilled machinists into the role of machine tenders.

Braverman acknowledged that machines could be designed in a variety of ways. Moreover, unlike a strict materialist, he argued that American management's ideology of control determined which designs were commissioned and deployed, a case later made in greater detail by Noble (1984). Nevertheless, Braverman told a decidedly deterministic story of NC tools' effects and his analysis, in retrospect, unwittingly hinged on the technical specifics of the type of NC tools used at the time he wrote—programs written to and stored on paper tapes. Braverman and those who adopted his perspective (Crompton and Reid 1982; Kraft 1979; Zimbalist 1979) also ignored the possibility that workers, like management, might have agency. Early deskilling theory, therefore, can be understood as a Marxist analogue of strategic choice theory: managers choose the technology and the technology's effects then follow more or less mechanically.

Braverman's portrayal of deskilling in machine shops spawned a sizable literature on the implications of numerical control. As a result, NC became the most well researched technology in the history of organization studies. Although early studies supported Braverman's contentions (Noble 1979), later research cast doubt on deskilling's ubiquity. Some researchers noted that only skilled machinists could compensate for poor programs during the machining process and that Braverman too easily dismissed the machinists' considerable formal and informal power on the shopfloor (Aronowitz 1978; Burawoy 1979). In other words, Braverman and other deskilling theorists attributed insufficient agency to the "tenders" of the machines.

Other researchers noted that whether employers used NC to deskill depended on their attitudes and backgrounds (Buchannan and Boddy 1983) and on the organizational and economic contexts of the machine shop. Deskilling was less common in smaller machine shops, in shops where owners and foremen were former machinists, and in shops that specialized in small production runs (Keefe 1991; Wood 1982). Ultimately, however, one of the most important predictors of NC's effects proved to be the machine tools' design and how the specifics of the design affected practice. With the shift from paper tapes to disk storage, manufacturers began to equip machine tools with line editors, the functional equivalent of a terminal. As early as 1984, researchers began to observe that machinists who ran the new Computer Numerically Controlled (CNC) machine tools were debugging and even writing programs using line editors. By the late 1980s, CNC machines were equipped with their own microcomputers, which enabled full scale programming at the machine. Qualitative and quantitative studies of machining have subsequently shown that the separation of cognition from execution is uncommon with advanced CNC machines (Kelley 1986; Shaiken 1984). In other words, the advent of microcomputers and disk storage enabled machinists to reassume programming tasks, often with the encouragement of employers. In fact, machinists often indicate that numerically controlled machine tools have expanded their skill set (Gallie 1994). Thus, the research literature on NC technology unintentionally illustrates why adequate accounts

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of technological change require hybrid explana-
tions that weave together human action and
choice, the functions and features of specific tech-
nologies, and the contexts of a technology's use
in a way that attends to the micro-dynamics of
situated practice.

It is precisely such an orientation that greater
familiarity with the IT literature might foster within
organizational studies. In general, IT research
tends to be more particularistic than organizational
research and remains closer to the technological
object of interest. Since the focus of IT research
often involves a specific technology's design and
use, IT researchers are more likely to take
technical details into account. From encounters
with the IT literature, organizational scholars might
develop a more nuanced appreciation for why and
how the material properties of technologies
matter. They might also acquire sufficient tech-
nical knowledge to develop better images of how
forms of organizing emerge as human action
weaves itself around a technology's constraints
and affordances. The fledgling literature on
computer-supported cooperative work (CSCW)
offers a glimpse of one such fusion and nicely
illustrates what IT can offer organization studies.

An Illustration: Computer-Supported Cooperative Work (CSCW)

Research into computer-supported cooperative
work emerged out of human-computer interaction
research in the mid-1980s as a collaborative effort
among computer scientists, software designers,
and social scientists who were interested in
developing technologies to support collaborative
work (Greif 1988). The general philosophy was
that designers could more adequately formulate
system requirements if they made use of descrip-
tions of work practices produced by social
scientists. Over the last decade, members of the
CSCW community have written a number of
papers on integrating ethnography and systems
design based on attempts to use data on work
practices to design and redesign technological
systems (Hughes et al. 1993; Simonson and
Kensing 1997). CSCW researchers begin with the
assumption that technical attributes shape social

dynamics and visa versa. The branch of the
CSCW literature that we shall call "studies of
situated coordination" is especially relevant
because it illustrates how understanding the ways
in which people use technologies could stimulate
new theories of organizing. Studies of situated
coordination explicitly examine how organization
emerges out of ongoing and mundane interactions
between individuals and their tools.

Students of situated coordination have examined
settings in which groups employ an array of
technologies and artifacts to organize not only
their own work, but the moment-by-moment
functioning of complex systems such as air traffic
control (Harper and Hughes 1993), airport ground
operations (Goodwin and Goodwin 1996; Such-
man 1993), subway control (Heath and Luff 1992),
and the bridges of naval vessels (Hutchins 1990,
1995). In the organization studies literature, Weick
and Roberts (1993) have labeled such settings
high reliability organizations. Researchers of
situated coordination who work in the CSCW area
differ from those who study high reliability systems
in that they draw heavily on the traditions of
ethnomethodology, a sociological approach not
well represented in organization studies. They also
pay more attention to the attributes of technology
than do organizational theorists or, for that matter,
even more traditional ethnographers of work.

The typical study of situated coordination exa-
mines how workers orient to each other and to
their tasks using emerging information and tech-
nologies at hand. Researchers of situated coordi-
nation are adept at portraying techno-social inter-
action orders: the practical logic of behavioral
sequences among co-oriented individuals who
jointly use tools and artifacts to solve problems in
the here-and-now. As is the case with most
ethnomethodological studies, research on situated
coordination highlights the discovery and repair of
breaches of a steady state. Although students of
situated coordination have not explicitly developed
a theory of organizing—in part because ethno-
methodology's agenda eschews explicit theory
building—their research is packed with concepts
that could be used as potential primitives for such
a theory. Examples include articulation work
(Bannon 1998; Suchman 1996), distributed cogni-

tion (Hutchins 1995; Rogers 1993), witnessability (Harper and Hughes 1993), shared information spaces (Schmidt and Bannon 1992), and centers of coordination (Suchman 1993). These concepts are promising precisely because they emerged out of grounded observations of the way human activity and technology are entwined and, in fact, often refer to that entwining. As a consequence, such concepts represent a way of talking about organizing as a concrete activity that simultaneously shapes and is shaped by the properties of the technologies that people use.

What IT Research Can Learn From Organization Studies ████

The labels that IT researchers have used over the years to describe their field chronicle an evolving image of the field and its subject matter: computing machinery, electronic data processing, computer information processing, information systems, management information systems, and information technology. Yet despite changes in name, IT research has long centered on the invention, implementation, and implications of computer technologies at various levels of analysis. The IT literature includes research on information systems, development projects, infrastructures, and computer networks. Furthermore, IT scholars have examined technological change with respect to individual, group, organizational, and inter-organizational dynamics. Beneath this diversity, however, lies considerable order. Most studies contribute to one of three broad genres of research: (1) studies of the impacts of information technology; (2) studies of the development, deployment and use of information technology; and (3) studies of the organization and management of information technology resources.

Genres of IT Research

Those who study the impact of information technology usually attend to social and economic consequences similar to those that interest students of organization. For instance, investigators have asked whether IT promotes deskilling or reskilling (Attewell and Rule 1984), favors decentralization or centralization (Bloomfield and Coombs 1995; George and King 1991; Robey 1981), alters communication patterns or organizational structures (Huber 1990; Malone et al. 1987; Sproull and Kiesler 199) and enhances the performance of individuals (Grant and Higgins 1991; Kraut et al. 1988; Todd and Benbasat 1999), groups (Kraemer and Pinsonneault 1990; Zack and McKenney 1995), or firms (Brynjolfsson 1993; Gurbaxani and Whang 1991; Weill 1993). Given that students of IT impacts share interests with organizational researchers, it is unsurprising that they often draw heavily on the organization studies literature. In fact, the IT literature on impacts resembles the organization studies literature in that it is the least likely of the three genres to attend to a technology's material constraints and affordances, and many who publish papers on IT impacts also publish frequently in organization studies journals.

By comparison, research on the development, deployment, and use of information technologies concentrates more intently on the technical and practical exigencies of implementing and operating information systems. The central research questions in this body of research include how to design better technological systems, how users can more effectively adopt and appropriate technologies, and how technologies can more consistently produce desired outcomes. Although these issues are not as central in the organization studies literature, organization studies have strongly influenced researchers who study development, deployment, and use with respect to the concepts they employ and the outcomes they examine. For example, IT researchers have examined how organizational characteristics such as task variety, executive support, and user participation shape the outcomes of implementation (Bostrom and Heinen 1977; Franz and Robey 1984; Ginzberg 1981; Lucas 1975). Others have explored how psychological and cognitive processes (Boland and Tenkasi 1995; Davis 1989; Ives et al. 1983; Orlikowski and Gash 1994; Robey and Sahay 1996) and politics, culture, and strategy (Hirschheim and Newman 1991; Kling

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1991; Markus 1983; Markus and Bjørn-Andersen 1987; Walsham 1993) affect a technology's acceptance, implementation, and use. At a more systemic level, investigators have asked how patterns of technological diffusion (Cooper and Zmud 1990; Fichman and Kemerer 1998) and critical mass (Markus 1987) affect when and how people deploy and use technologies.

The third broad genre of IT research speaks to organizing and managing IT services. Because this body of work focuses on how to deliver technology-based solutions, researchers attend carefully to the material aspects of an IT infrastructure, including configurations of hardware and software, the use of common standards and tools across an entire organization, and the maintenance of legacy systems. Since these issues are strategic in nature, those who write about managing IT resources have made considerable use of macro-organizational research, especially research on organizational strategy, governance, and resource control. IT researchers have found the work of organizational theorists useful for examining a variety of questions, including: are centralized, decentralized, or federal governance structures more appropriate for IT activities (Sambamurthy and Zmud 1999; Zmud 1984); how should IT departments relate to other organizational functions (Brown and Magill 1994; Henderson and Venkatraman 1993); where and how should firms source IT services (Lacity and Hirschheim 1993; Lacity et al. 1996; Venkatraman 1997); how should firms recruit and retain IT professionals (Agarwal and Ferratt 1999); and what are the best ways to develop and manage IT infrastructures (Broadbent et al. 1999; Weill and Broadbent 1998)? Recently, those who contribute to this stream of research have begun to ask which IT capabilities and architectures (both organizational and technological) are most suitable for a digital economy (Sambamurthy and Zmud 2000).

The Institutional Context of Technology

In short, IT researchers have, over the years, drawn liberally on concepts, propositions, instru-

ments, and techniques developed by students of organizations. Such borrowing has brought greater sensitivity to the cognitive, political, and strategic dynamics of organizational life into the IT literature. However, despite the considerable influence of organization studies, IT researchers have yet to make much use of more recent developments in organization theory that include themes of institutionalization, globalization, entrepreneurship, and post-modernity. We will consider one such development here—institutional theory—which has become prominent in organization studies over the last two decades (after an earlier and short-lived appearance in the 1950s). With few exceptions (e.g., Barrett and Walsham 1999; King et al. 1994; Kling and Iacono 1988), IT researchers have yet to ask how institutions influence the design, use, and consequences of technologies, either within or across organizations. The field's practical interest in the development, use, and management of information systems may have diverted analysts to lower levels of analysis and, hence, away from studying how regulative processes, normative systems, and cultural frameworks shape the design and use of technical systems.

Institutional analysis examines how broad social and historical forces, ranging from explicit laws to implicit cultural understandings, affect and are affected by the actions of organizations. Institutional research in organizations, particularly that known as "the new institutionalism" (Powell and DiMaggio 1991), emerged as a counterpoint to organizational theories that treat organizations and managers as rational actors. In contrast to other organizational theorists, institutionalists champion cognitive and cultural explanations for organizational responses. Barley and Tolbert (1997, p. 93) put it this way:

> organizations, and the individuals who populate them, are suspended in a web of values, norms, rules, beliefs, and taken-for-granted assumptions, that are at least partially of their own making.

For instance, Zucker (1977) argued that the stability and persistence of organizations rests on beliefs which are developed and maintained

across generations of organizational actors and that resist change. Similarly, DiMaggio and Powell (1983) accounted for the homogeneity of organizational structures and practices by pointing to coercive and mimetic processes that drive organizations to adopt culturally legitimate forms and routines.

Institutional influences both enable and constrain action. Institutionalists view organizations not as passive pawns controlled by the demands of their environments, but as active players, capable of responding strategically and innovatively to environmental pressures (Scott 1995). Consider for example the relevance of an institutional perspective on the expanding use of Internet technology. Since 1991, when restrictions on the commercialization of the Internet were eased, firms have increasingly employed networking technologies to interact with customers, suppliers, and consumers. Largely as a result, traffic on the U.S. Internet backbone currently doubles each year (Guice 1998). IT researchers have begun to study the socio-economic implications of the Internet (Brynjolfsson and Kahin 2000), but to the degree that such research ignores the influence of institutions, it risks promoting an overly rational and technologically or economically determined view of the digital economy. Simplistic determinism is evident in both popular and academic discourse which regularly treats "the digital economy" as if it were an independent, objective and inevitable phenomenon (Orlikowski and Iacono 2000). Consider, for example, exuberant predictions of "frictionless" electronic commerce (Bakos 1998), "the death of distance" (Cairncross 1997), "plug and play interoperability" (Shaw 1999) and "cut-and-paste" virtual organizations (Mowshowitz 1997).

An institutional perspective would offer IT researchers a vantage point for conceptualizing the digital economy as an emergent, evolving, embedded, fragmented, and provisional social production that is shaped as much by cultural and structural forces as by technical and economic ones. Faced with new forms of electronic exchange, distribution, and interaction, IT researchers cannot reasonably confine their interests to the problems of developing and

implementing technologies or even to studying a technology's impact on local contexts. A world of global networking (both technological and organizational) raises issues of institutional interdependence whose understanding requires an appreciation for how prior assumptions, norms, values, choices, and interactions create conditions for action and how subsequent action produces unintended and wide-reaching consequences. Recognition of the institutional implications of electronic commerce would focus attention on such complex issues as the blurring of corporate boundaries, national sovereignty, organizational control, intellectual property, individual privacy, and internetworking protocols. Without an institutional lens, IT research might focus more narrowly on technological designs, economic imperatives, or psychological impacts, thus missing important social, cultural, and political aspects of electronic commerce.

IT research continues to benefit considerably from its engagement with the OS literature. However, the focus of this engagement remains largely rooted in issues of systems implementation, use, impacts, and resource management within particular contexts. By expanding this focus to include insights from institutional theory, IT researchers might develop a more structural and systemic understanding for how technologies are embedded in complex interdependent social, economic, and political networks, and how they are consequently shaped by such broader institutional influences.

Toward a More Technological and Institutional View of Telecommuting

To illustrate how organizational theories of technological change might profit from greater familiarity with the IT literature and how IT might benefit from an appreciation of institutional forces, consider one of the most significant techno-social developments in recent years: telecommuting. Originally coined by Jack Nilles (1975), telecommuting refers to using telecommunications lines, com-

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puters, and other office technologies (such as pagers, telephones, and faxes) to work from a site other than one's assigned office. Although people can work remotely from a variety of locations including satellite offices, airports, or hotel rooms, most of the literature presumes that telecommuters work from home. In fact, commentators sometimes equate telecommuting with home work and frequently speak of telecommuting as a substitute for "working in the office."

Organizational researchers did not attend to telecommuting until the mid-1980s, nearly a decade after the idea emerged. Moreover, interest in the topic still remains sparse when compared to the wealth of commentary on telecommuting found in the popular business and IT press. As might be expected, most organizational studies of telecommuting make only passing reference to how the capabilities of new technologies affect trends in telecommuting and other types of remote work. Instead, organizational researchers focus almost exclusively on two issues: telecommuting's implications for the individual worker's experience and the organizational and institutional constraints that limit telecommuting's spread. Few articles discuss both and most address the first.

Studies of telecommuting's implications for individuals usually compare telecommuters to traditional office workers with respect to job satisfaction, autonomy, productivity, social isolation, stress, and the ability to manage work and family issues. An interest in ameliorating conflicts between work and family has motivated many studies, whose authors have viewed telecommuting as a compromise for working women who might otherwise have to choose between working and raising children (Duxbury et al. 1998; Foegen 1984). Others have extended this line of thinking to the quality of working life for both genders (Bailyn 1988, 1993; Shamir and Salomon 1985). In either case, telecommuting is conceived of as way of working that contrasts sharply with traditional understandings of how work should be organized, understandings that are deeply embedded in our culture. Specifically, telecommuting violates the separation of work and home that has characterized industrial employ-

ment since the 19th century. Thus, it is reasonable to say that the individual-level literature on telecommuting is designed to test indirectly whether telecommuting's violation of this key institution is beneficial for telecommuters, employers, and family members. By and large, the individual-level literature portrays telecommuting as a positive development for workers and employers alike.

A second and much smaller stream of organizational research on telecommuting addresses institutional issues head on. These papers typically adopt a more pessimistic view. The research agenda is to explain why telecommuters experience difficulties and why managers are reluctant to endorse telecommuting wholeheartedly (Bailyn 1993; Kurland and Egan 1999; McDavid 1985; Pontell et al. 1986; Tomaskovic-Devey and Risman 1993). Perin (1991) argues that employment relations have long entailed a strong element of social control but that mechanisms of control have varied by type of work. Employers found it relatively easy to monitor factory and clerical workers because their output was tangible and directly measurable. Because manual and clerical work involved physical transformations of material artifacts, it was relatively easy to tell when workers were shirking. In contrast, because managerial and professional work is primarily mental and interpersonal, it cannot be so easily monitored. As a result, managers use presence in the workplace as a proxy for productivity and as a basis for promotion (Perlow 1997).

Studies have shown that managers resist telecommuting because they fear employees will exert less effort when they are no longer visible to supervisors. Conversely, workers fear that telecommuting will undermine their careers by making them less visible for promotion. Thus, institutionally oriented research argues that telecommuting not only challenges existing practices, but that cultural inertia is a significant constraint on the spread of telecommuting. The institutional literature implies that despite its technical feasibility, full-time telecommuting is relatively rare because social and cultural traditions have yet to change.

Although there is little doubt that telecommuting violates long established understandings of where and when work should occur, by emphasizing cultural inertia organizational researchers may have overlooked a sea change in how work is temporally and spatially distributed. The problem arises in part because researchers have defined telecommuting as a substitute for office work and, in part, because they have not attended closely enough to evolving technological trends. Awareness of the latter is greater in the IT world.

Although academic IT researchers have sporadically published articles on telecommuting, most have mirrored the concerns of the OS literature (e.g. DeSanctis 1984; Mokhtarian and Bagley 1997; Olson 1987, 1989; Venkatesh and Vitalari 1992).[2] A radically different perspective on telecommuting can be found, however, in publications such as *PC Magazine*, *Datamation*, *Computerworld*, and *Byte,* which are aimed at practicing IT professionals. Such outlets published the first articles on telecommuting in the late-1970s. The practical literature on telecommuting revolves around four themes.

First, the IT literature for practitioners is strongly materialistic and optimistic about the spread of telecommuting. Most commentators base their optimism on the emergence of technologies that promise to make telecommuting cheaper, quicker, more reliable, and, hence, possible for an ever larger number of people. In fact, one can read this literature as a history of the technologies on which technologists have successively pinned their hopes for telecommuting. In the early 1980s, articles spoke primarily of remote terminals and modems in the home. During the second half of that decade, mention of remote terminals was replaced by references to the personal computer. Beginning in the early 1990s, talk of microcomputers (including laptops) was eclipsed by mention

of local area networks (LANs), Integrated Services Digital Networks (ISDN lines), cable modems, and other telecommunications technologies that promised greater bandwidth. By the late 1990s, discussions of network technologies were augmented by discussions of the Internet and the World Wide Web.

That telecommuters represent an emerging market for information technologies is a second theme in the popular IT literature (Dziak 1993; Kocher 1993 Ohlhausen 1992). Discussions of telecommuters as a new market first appeared in the early 1990s and were tied, in part, to the passage of the Clean Air Act of 1990, the Americans with Disabilities Act of 1991, and the Family and Medical Leave Act of 1993. Of the three, the most influential was the Clean Air Act, which mandated that firms with over 100 employees take steps to reduce by 25% the number of employees who commuted to work. Like the popular business press of the time, the IT press portrayed telecommuting as a way to comply with the laws' requirements without significant expense (Armstrong 1993; Harler 1993). More recently, telecommuting has been discussed as a way of reducing a firm's real estate costs (Apgar 1998).

In recent years, the practitioner literature has linked telecommuting to the growth of contract labor, the rise of mobility and the increasing irrelevance of the office in a global economy (Davenport and Pearlson 1998). Contractors are portrayed as free agents who work from home and other remote sites. Telecommuting reputedly allows firms to tap the expertise of individuals whose skills are in high demand but who do not wish to be tied down by permanent employment. Similarly, telecommuting is seen as a solution to the difficulties of integrating and communicating with employees whose work is decoupled from time and place. The IT press views telecommuting as a precondition for and the *modus operandi* of an increasingly mobile and geographically dispersed workforce.

Finally, most popular IT articles predict significant increases in the frequency of telecommuting, regardless of the year in which they were published. Often the population of potential tele-

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[2]The fact that IT researchers have approached telecommuting from the same perspectives as organizational theorists may be read as evidence that organization studies' influence on IT may sometimes be too great. The technological focus found in the popular IT literature and more characteristic of other streams of IT research is, as we shall argue, critical to unraveling the institutional puzzle surrounding telecommuting.

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commuters is said to be quite large. As early as 1981, Cole estimated that 10% of the population would be working from home by the turn of the century. In 1985, estimates ran from 10 million to 20 million telecommuters by the 1990s (Antonoff 1985; D'Attilo 1985; Regenye 1985). In 1992, Burger noted that 60% of the working population were potential telecommuters. Romei (1992) was more conservative and estimated 33%. In 1997, Wallace announced that 25.7 million people would telecommute by the turn of the century. Despite such optimism, the number of telecommuters has always remained smaller than anticipated. After reviewing studies that estimate the number of telecommuters in the United States, O'Mahony and Barley (1999) concluded that the best data suggest that in 1992 only a quarter of a percent (.26) of the working population telecommuted full time and in 1997 only 6.7% of all permanent employees telecommuted in any form whatsoever.

While the popular IT press may be overly optimistic about the spread of telecommuting as a substitute for working in the office, commentators are undoubtedly correct in pointing to explosive growth in the infrastructure that allows people to work remotely. A rapidly growing percentage of American households have personal computers, laptops, modems, cable connections, high speed telephone lines, and Internet access (International Data Corporation 1998; National Telecommunications and Information Administration 1997). In many cases, employers have provided this equipment. These facts raise an interesting puzzle: how can one reconcile the increasing ubiquity of work-related computing in the home with the organizational theorists' observation that full-time telecommuting is rare because institutional forces have constrained its spread?

Organizational theorists might argue that the popular IT literature is simply naive or wrong-headed. Popular commentary on telecommuting focuses almost entirely on technologies that allow people to work remotely. Although one can find references to organizational and even social resistance to the practice of working from home, sheer technical feasibility is usually seen as the most significant constraint on the spread of telecommuting. Articles written for IT practitioners, therefore, portray each significant new

technology that increases bandwidth, transmission speed, and access to information as a miniature technological revolution that will launch extensive social change. This tendency to conflate technical feasibility with social probability encourages overly optimistic estimates of telecommuting's incidence and spread.

There is, however, another possibility: neither the popular IT nor the OS (and academic IT) literature on telecommuting adequately envisions reality. Instead, each discusses a feature of the current situation without developing an integrated understanding. The popular IT literature correctly argues that new technologies have made it possible for people to work at a distance and that distance work has become increasingly common. Similarly, organizational theorists correctly argue that telecommuting must be viewed against the backdrop of institutional and cultural forces, including institutional inertia. Yet despite these insights, neither view comes to grip with the social dynamics of telecommuting because neither has investigated how people integrate telecommuting into their daily lives.

The oversight stems, in part, from the fact that both literatures define telecommuting as the converse of working in an office. Further, neither begins with actual practice. Finally, each adopts an inadequate temporal perspective. The popular IT literature insists on interpreting present conditions against future possibilities, while the OS literature interprets the present in terms of the past. What would be more effective for both technological and organizational analyses would be an empirical description of what is actually going on in practice today.

Although the number of full-time telecommuters appears to be small, many people work remotely either a few days a month or, more frequently, a few hours a day. The number of people whose employers provide computers for use at home or on the road is growing, just as the popular IT literature suggests. Furthermore, under the banner of the distributed office and the mobile worker, a growing number of firms have begun to reduce the ratio of offices to employees. To reduce ratios, workers are encouraged to work at home, at customer sites, or at drop-in centers.

Taken together, these data suggest that telecommuting is perhaps best construed not as a substitute for office work but as a supplement. If true, then one would expect that telecommuting might lead to an increase in the number of hours that people work as homes become extensions of the workplace.

In short, what appears to be developing with respect to telecommuting is different than what is entailed by either an institutional or a technological view. Each view deals with an important piece of the puzzle, but fails to come to grips with practice because it lacks what the other offers. The pragmatic orientation of the IT practitioner literature rightly emphasizes that telecommuting depends on the availability of technical infrastructure. The concern with institutional dynamics by the organizational literature accurately explains why full-time telecommuting has never caught on. The puzzle that has yet to be unraveled is this: how can remote computing be on the rise while telecommuting seems to be growing slowly? The answer seems to be that even though institutions militate against substituting home work for office work, existing cultural norms *are* consistent with using the infrastructure to increase the number of hours that employees work and, in many cases, to appropriate the use of the employee's home at little cost. Thus, because the popular IT literature has been preoccupied with the power of technology, it has failed to acknowledge how powerfully institutional pressures can maintain the status quo. On the other hand, by ignoring the potential of technology, organizational scholars have failed to recognize the role that networked computers may play in breaking down the separation of work and home, long the hallmark of social relations under industrial capitalism. One could hardly ask for a more significant social change!

Conclusion

If we are enmeshed in the shift from an industrial to a post-industrial society, it is quite likely that new perspectives will be required to make sense of what is happening and where we are headed. Furthermore, to the degree that this socio-

economic transformation rests on the emergence of new technological infrastructures and entails the rise of new forms of organizing, maintaining strong boundaries between fields that specialize in technology and organization is counter-productive. By definition, understanding and guiding techno-social developments requires knowledge of technological systems, social processes, and their interactions. Unfortunately, the boundaries that we have drawn around our disciplines currently hamper the development of a more integrated approach.

Our intent in this essay has been to suggest what might be gained by fostering more interplay between the fields of organization studies and information technology. Our agenda is not to bring about a complete fusion of the two fields, but rather to encourage hybrid research and theory at those points where the two fields intersect. We imagine the hybrid as being different from the mainstream of both fields, possibly in terms of content but certainly in terms of epistemology. In particular, we advocate for research that requires substantive expertise in both technology and the social dynamics of organizing and that embraces the importance of simultaneously understanding the role of human agency as embedded in institutional contexts as well as the constraints and affordances of technologies as material systems.

Our sense is that, to make such an epistemological journey, organizational scholars have further to go than do researchers in information technology. The imbalance is not simply a reflection of the fact that IT has already drawn more on organization studies than the reverse, although this is undoubtedly the case. In addition, students of organizations face the task of learning about and remaining current in the particulars of technological systems, which change much more quickly than do the dynamics of social systems. Given this difficulty, it may be that a more effective approach to hybrid studies is to foster collaboration between students of organizations and students of information technology, as has occurred between social and computer scientists in the area of CSCW research.

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The value of integrating OS with IT in hybrid studies goes beyond informing one field by the other to a possibility of new syntheses that fuse accounts of human agency, material constraints/affordances, and institutional dynamics into richer explanations of techno-social change. Such a fusion could occur at various levels of analysis and take different forms, but it is likely to require that researchers pay attention to situated dynamics as they emerge and change through time. This is undoubtedly easier at lower levels of analysis. The difficulty lies not in the fact that macro-social changes are less emergent than changes in local practices, but rather that the latter occur over shorter time spans. For example, any story of how the electrical system emerged in the U.S. must simultaneously take into account the development of technical capabilities as well as concerted political action on the part of specific interest groups (Hughes 1983; Nye 1990). Ultimately, a satisfying account of the emergence and production of a digital economy based on the Internet must also evince such a fusion of forces, capabilities, and actions.

Nevertheless, when studying individuals and groups engaged in situated practice, it is possible for researchers to observe ongoing action and to collect multiple instances from which more generalizable statements may be inferred. This, in part, explains the achievements of CSCW research. With respect to techno-social developments at the level of economies and societies, time frames may extend beyond the purview of single scholars, so that in the end historians must tell the story. Nevertheless, an appreciation for how technological systems interact with political actions and human choices over time to produce complex, emergent phenomena may provide both OS and IT with the sensitivity for developing more powerful explanations of the technical and institutional milieu of post-industrial economies.

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