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Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory

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DeSanctis and Poole contribute to the organization sciences in two distinct ways. First, they insightfully probe and characterize the *deep structures* that exist within both the technological artifacts and the work environments within which these artifacts are applied (within the context of a given technology—group decision support systems). Second, they describe and illustrate innovative strategies for *collecting data on these structures*. In doing so, the authors have laid an extremely strong foundation for future scholarship exploring the “evolution-in-use” as well as the organizational impacts of advanced information technologies.

Robert W. Zmud

Abstract

The past decade has brought advanced information technologies, which include electronic messaging systems, executive information systems, collaborative systems, group decision support systems, and other technologies that use sophisticated information management to enable multiparty participation in organization activities. Developers and users of these systems hold high hopes for their potential to change organizations for the better, but actual changes often do not occur, or occur inconsistently. We propose *adaptive structuration theory* (AST) as a viable approach for studying the role of advanced information technologies in organization change. AST examines the change process from two vantage points: (1) the types of structures that are provided by advanced technologies, and (2) the structures that actually emerge in human action as people interact with these technologies. To illustrate the principles of AST, we consider the small group meeting and the use of a group decision support system (GDSS). A GDSS is an interesting technology for study because it can be structured in a myriad of ways, and social interaction unfolds as the GDSS is used. Both the structure of the technology and the emergent structure of social action can be studied.

We begin by positioning AST among competing theoretical perspectives of technology and change. Next, we describe the theoretical roots and scope of the theory as it is applied to GDSS use and state the essential assumptions, concepts, and propositions of AST. We outline an analytic strategy for

applying AST principles and provide an illustration of how our analytic approach can shed light on the impacts of advanced technologies on organizations. A major strength of AST is that it expounds the nature of social structures within advanced information technologies and the key interaction processes that figure in their use. By capturing these processes and tracing their impacts, we can reveal the complexity of technology-organization relationships. We can attain a better understanding of how to implement technologies, and we may also be able to develop improved designs or educational programs that promote productive adaptations. (*Information Technology; Structural Theory; Technology Impacts*)

1.0. Introduction

Information plays a distinctly social, interpersonal role in organizations (Feldman and March 1981). Perhaps for this reason, development and evaluation of technologies to support the exchange of information among organizational members has become a research tradition within the organization and information sciences (Goodman 1986, Keen and Scott Morton 1978, Van de Ven and Delbecq 1974). The past decade has brought *advanced information technologies*, which include electronic messaging systems, executive information sys-

tems, collaborative systems, group decision support systems, and other technologies that enable multiparty participation in organizational activities through sophisticated information management (Huber 1990, Huseman and Miles 1988, Rice 1984). Developers and users of these systems hold high hopes for their potential to change traditional organizational design, intelligence, and decision-making for the better, but what changes do these systems actually bring to the workplace? What technology impacts should we anticipate, and how can we interpret the changes that we observe?

Many researchers believe that the effects of advanced technologies are less a function of the technologies themselves than of how they are *used* by people. For this reason, actual behavior in the context of advanced technologies frequently differs from the “intended” impacts (Kiesler 1986, Markus and Robey 1988, Siegel, Dubrovsky, Kiesler and McGuire 1986). People adapt systems to their particular work needs, or they resist them or fail to use them at all; and there are wide variances in the patterns of computer use and, consequently, their effects on decision making and other outcomes. We propose *adaptive structuration theory* (AST) as a framework for studying variations in organization change that occur as advanced technologies are used. The central concepts of AST, structuration (Bourdieu 1978, Giddens 1979) and appropriation (Ollman 1971), provide a dynamic picture of the process by which people incorporate advanced technologies into their work practices. According to AST, adaptation of technology structures by organizational actors is a key factor in organizational change. There is a “duality” of structure (Orlikowski 1992) whereby there is an interplay between the types of structures that are inherent to advanced technologies (and, hence, anticipated by designers and sponsors) and the structures that emerge in human action as people interact with these technologies.

As a setting for our theoretical exposition, we consider the small group using a *group decision support system* (GDSS). A GDSS is one type of advanced information technology; it combines computing, communication, and decision support capabilities to aid in group idea generation, planning, problem solving, and choice making. In a typical configuration, a GDSS provides a computer terminal and keyboard to each participant in a meeting so that information (e.g., facts, ideas, comments, votes) can be readily entered and retrieved; specialized software provides decision structures for aggregating, sorting, and otherwise managing the meeting information (Dennis et al. 1988, DeSanctis and Gallupe 1987, Huber 1984). A GDSS is an inter-

esting technology for study because its features can be arranged in a myriad of ways and social interaction is intimately involved in GDSS use. Consequently, the structure of the technology and the emergent structure of social action are in prominent view for the researcher to study. There currently is burgeoning interest in GDSSs and their potential role in facilitating organizational change. GDSS is a rich context in which to expound AST, but the principles of the theory apply to the broad array of advanced information technologies.

In this paper we outline the assumptions of AST and detail a methodological strategy for studying how advanced technologies such as GDSSs are brought into social interaction to effect behavioral change. We begin by positioning AST among an array of theoretical perspectives on technology and change. Next, we describe the theoretical roots and scope of the theory and state the essential assumptions and concepts of AST. We summarize the relationships among the theoretical constructs in the form of propositions; the propositions can serve as the basis for specification of variables and hypotheses in future research. Finally, we outline a method for identifying structuring moves and present an illustration of the theory’s application. Together, the theory and method provide an approach for penetrating the surface of advanced technology use to consider the deep structure of technology-induced organizational change.

2.0. Theoretical Roots of AST

2.1. Competing Views of Advanced Information

Technology Effects

Two major schools of thought have pursued the study of information technology and organizational change (see Table 1). The *decision-making school* has been more dominant. This school is rooted in the positivist tradition of research and presumes that decision making is “the primordial organizational act” (Perrow 1986); it emphasizes the cognitive processes associated with rational decision making and adopts a psychological approach to the study of technology and change. Decision theorists espouse “systems rationalism” (Rice 1984), the view that technology should consist of structures (e.g., data and decision models) designed to overcome human weaknesses (e.g., “bounded rationality” and “process losses”). Once applied, the technology should bring productivity, efficiency, and satisfaction to individuals and organizations. Variants within the decision school include “task-technology fit” models (Jarvenpaa 1989), which stress that technology must match work tasks in order to bring improvements in

Table 1 Adaptive Structuration Theory Blends Perspectives from the Decision-making School and the Institutional School

Major Perspectives on Technology and Organizational Change	Characteristics of Each Perspective	Examples of Theoretical Approaches
Decision-making School	focus on technology engineering hard-line determinism relatively static models of behavior positivist approach to research ideographic, cross-sectional research designs	decision theory (Keen and Scott Morton 1978) task-technology "fit" (Jarvenpaa 1989) "garbage can" models (Pinfield 1986)
Social Technology School (integrative perspectives)	focus on technology and social structure soft-line determinism mixed models of behavior positivist and interpretive approaches are integrated	sociotechnical systems theory (Bostrom and Heinen 1977, Pasmore 1988) structural symbolic interaction theory (Saunders and Jones 1990, Trevino et al. 1987) Barley's (1990) application of structuration theory Orlikowski's (1992) structurational model adaptive structuration theory
Institutional School	focus on social structure nondeterministic models pure process models interpretive approach to research nomothetic, longitudinal	segmented institutional (Kling 1980) social information processing (Fulk et al. 1987, Salancik and Pfeffer 1978, Walther 1992) symbolic interactionism (Blumer 1969, Reichers 1987) structuration theory (Giddens 1979) research designs

work effectiveness, and so-called "garbage can" models (Pinfield 1986), which emphasize the timing of events and the need for technology to support information scanning and information search activities.

Decision theorists tend toward an engineering view of organizational change, believing that failure to achieve desired change reflects a failure in the technology, its implementation, or its delivery to the organization. Research hypotheses are grounded in either hard-line determinism, the belief that certain effects inevitably follow from the introduction of technology, or more moderate contingency views, which argue that situational factors interact with technology to cause outcomes (see Gutek, Bikson and Mankin 1984). Decision theorists favor positivist research approaches that measure—typically in quantitative terms—the effects of technology manipulation on outcomes (Orlikowski and Baroudi 1991).

Within the GDSS literature, technology design guidelines put forth by Dennis et al. (1988), DeSanctis and Gallupe (1987), and Huber (1984), and experimental studies conducted by Jarvenpaa, Rao, and Huber (1988), Watson, DeSanctis and Poole (1988), and others (Connolly, Jessup and Valacich 1990, Gallupe, DeSanctis and Dickson 1988, George et al. 1990) exemplify the decision school perspective. This line of

research evaluates the effectiveness of GDSS technology by comparing groups given GDSS support with those given manual or no decision structuring, or by comparing groups given certain types of GDSS structures with those given alternative designs of structures. In general, researchers expect GDSS conditions to yield more desirable outcomes than groups in other conditions.

The decision school has yielded an extensive literature on GDSSs and other advanced technologies, but the approach has not produced a consensus on how these systems should be designed or on how they affect the people and organizations who use them.¹ For example, some researchers report that GDSS use improves group consensus and decision quality, whereas others report the reverse (see George et al. 1990). Similarly, a number of studies have found differences in attitudes or patterns of use of the same technology design across groups (e.g., Hiltz and Johnson 1990, Kerr and Hiltz 1982). Recently, decision researchers have tried to sort out GDSS impacts by isolating specific features or properties of the technology for study. For example, Connolly et al. (1990) manipulated anonymity and the evaluative tone of electronically communicated comments and measured effects on idea generation, solution quality, and satisfaction. Others

have considered the degree of “social presence” of the GDSS media (Hiltz and Johnson 1990); but these approaches have led to mixed results as well, with values on outcome measures begin improved in some cases and worsened in others (Jessup, Connolly and Galegher 1990).

There is no doubt that technology properties and contextual contingencies can play critical roles in the outcomes of advanced information technology use. The difficulty is that there are not clearcut patterns indicating that some technology properties or contingencies consistently lead to either positive or negative outcomes. Observed effects do not hold up robustly across studies, and, even more disturbing, there is often substantial variance in outcome measures within even one treatment of any given study (e.g., Jarvenpaa et al. 1988). To achieve greater consistency in empirical findings, decision school researchers advocate progressively finer, feature-at-a-time evaluation of technology and more complex contingency classifications schemes (e.g., see Pinsonneault and Kraemer 1989, Valacich, Dennis and Nunamaker 1992). The difficulty is, of course, the repeating decomposition problem: there are features within features (e.g., options within software options) and contingencies within contingencies (e.g., tasks within tasks). So how far must the analysis go to bring consistent, meaningful results?

Researchers within the *institutional school* advocate a different approach: the study of technology as an opportunity for change, rather than as a causal agent of change (Barley and Tolbert 1988, Kling 1980, Perrow 1986). The focus of study for institutionalists is less on the structures within technology, and more on the social evolution of structures within human institutions. Institutionalists criticize decision theorists for the “technocentric” assumption that technology contains inherent power to shape human cognition and behavior; this assumption, they contest, leads to “gadgetophilia,” an overemphasis on hardware and software and an underemphasis on the social practices that technologies involve (Finlay 1987, Markus and Robey 1988). A strategic choice model is advocated instead: technology does not determine behavior; rather, people generate social constructions of technology using resources, interpretive schemes, and norms embedded in the larger institutional context (Orlikowski 1992). Many institutionalist emphasize the role of ongoing discourse in generating social constructions of technology (e.g., Barley and Tolbert 1988, Scott 1987), with a consequent emphasis on human interaction (rather than technology per se) in studies of advanced technology effects.

Institutionalists began with the study of communities and society as a whole (Gidens 1979, Selznick 1969), but institutional theory has been developed for organizations as well (Kling 1980). Theoretical perspectives aligned with the institutional school in the study of organizations include social information, processing theory, which emphasizes the social construction of meaning (Fulk et al. 1987, Salancik and Pfeffer 1978, Walther 1992); and symbolic interactionism, which focuses on the role of communication in the creation and preservation of the social order, i.e., roles, norms, values, and other social practices (Reichers 1987). For institutionalists, the creation, design, and use of advanced technologies are inextricably bound up with the form and direction of the social order. It follows that studies of technology and organizational change must focus on interaction and capture historical processes as social practices evolve. Process-oriented methods are favored over outcome studies, and ideographic, interpretive accounts are preferred over nomothetic research designs (Barley and Tolbert 1988). Within the institutional school, technology is considered to be interpretively flexible (Orlikowski 1992), and so analysis is the process of looking beneath the obvious surface of technology’s role in organizational change to uncover the layers of meaning brought to technology by social systems.

There is growing interest in institutional analyses of advanced information technologies, including GDSSs, though actual accounts are sparse (Barley 1986, Finlay 1987, Markus and Forman 1989, Robey, Vaverek and Saunders 1989, Walther 1992). These analyses describe the interplay between technology and power distribution, politics, stratification, and other social processes. Institutional accounts of organizational change are inherently less interested in the properties of technology than in use of technology and the evolution of social practices. Consequently, the purely institutional approach underplays the role of technology in organizational change. A more complete view would account for the power of social practices without ignoring the potency of advanced technologies for shaping interaction and thus bringing about organizational change. Such a view would integrate assumptions from the decision-making and institutional schools and apply both positivist and interpretive research approaches.²

2.2. An Integrative Perspective

How might the decision and institutional perspectives be integrated? Several theoretical views synthesize assumptions from these competing schools to form what we will refer to as the *social technology perspective*.

This third school of thought advocates “soft-line” determinism, or the view that technology has structures in its own right but that social practices moderate their effects on behavior (Gueth et al. 1984). For example, sociotechnical systems theory argues that the impacts of advanced information technologies depend on how well social and technology structures are jointly optimized; technology adoption is interpreted as a process of organizational change (Bostrom and Heinen 1977, Hiltz and Johnson 1990, Pasmore 1988). Similarly, structuration theory, largely associated with Giddens’ institutional theory of social evolution (1979), has been applied to explain organizational adoption of computing and other technologies (Barley 1986, 1990, Orlikowski 1992, Orlikowski and Robey 1991, Robey et al. 1989).

A third social technology model, structural symbolic interaction theory, takes a more “micro” view, examining interpersonal interaction that occurs via electronic and other new media (Saunders and Jones 1990, Trevino, Lengel and Daft 1987). The theory explores the inherent structure of technology more fully than structural models, but it has been applied more to the study of peoples’ perceptions of technology than to their actual behavior. Also, the theory does not explain the dynamic way in which technology and social structures mutually shape one another over time.

Adaptive structuration theory extends current structuration models of technology-triggered change to consider the mutual influence of technology and social processes. AST provides a detailed account of both the structure of advanced technologies as well as the unfolding of social interaction as these technologies are used. Its goal is to confront “structuring’s central paradox: identical technologies can occasion similar dynamics and yet lead to different structural outcomes” (Barley 1986, p. 105). To present the theoretical propositions of AST, we focus here on small group interaction in the context of GDSS technology, but the concepts and relationships posited here could be applied to other advanced technologies and other organizational contexts. We consider both the structures of GDSS technology and the structures realized in interaction, but we particularly attend to the latter in this exposition. We leave more in-depth analyses of GDSS and related advanced information technology structures to other discussions (DeSanctis, Snyder and Poole in press, Huber, 1990, Silver 1991). The theoretical propositions presented here can be refined to formulate specific research hypotheses, thus providing an empirical research agenda (e.g., see DeSanctis et al. 1989, 1992, in press, Poole and DeSanctis 1992, Poole,

Holmes and DeSanctis 1991, Sambamurthy and Poole 1992).

3.0. Propositions of Adaptive Structuration Theory

AST provides a model that describes the interplay between advanced information technologies, social structures, and human interaction. Consistent with structuration theory, AST focuses on *social structures*, rules and resources provided by technologies and institutions as the basis for human activity. Social structures serve as templates for planning and accomplishing tasks. Prior to development of an advanced technology, structures are found in institutions such as reporting hierarchies, organizational knowledge, and standard operating procedures. Designers incorporate some of these structures into the technology; the structures may be reproduced so as to mimic their nontechnology counterparts, or they may be modified, enhanced, or combined with manual procedures, thus creating new structures within the technology. Once complete, the technology presents an array of social structures for possible use in interpersonal interaction, including rules (e.g., voting procedures) and resources (e.g., stored data, public display screens). As these structures then are brought into interaction, they are instantiated in social life. So, there are structures in technology, on the one hand, and structures in action, on the other. The two are continually intertwined; there is a recursive relationship between technology and action, each iteratively shaping the other. But if we are to understand precisely *how* technology structures can trigger organizational change, then we have to uncover the complexity of the technology-action relationship. This requires an analytical distinction between social structures within technology and social structures within action (Giddens 1979, Orlikowski 1992, Orlikowski and Robey 1991). Then the interplay between the two types of structures must be considered.

3.1. Advanced Information Technologies as Social Structures

Advanced information technologies bring social structures which enable and constrain interaction to the workplace. Whereas traditional computer systems support accomplishment of business transactions and discrete work tasks, such as billing, inventory management, financial analysis, and report preparation, advanced information technologies support these activities and more: they support coordination among people and provide procedures for accomplishing in-

terpersonal exchange. GDSSs, for example, provide electronic paths for exchanging ideas among meeting participants and formulas for integrating the work of multiple parties. In this sense, advanced information technologies have greater potential than traditional business computer systems to influence the social aspects of work.

The social structures provided by an advanced information technology can be described in two ways: the structural, features of the given technology and the spirit of this feature set. *Structural features* are the specific types of rules and resources, or capabilities, offered by the system. Features within a GDSS, for example, might include anonymous recording of ideas, periodic pooling of comments, or alternative voting algorithms for making group choices. They govern exactly how information can be gathered, manipulated, and otherwise managed by users. In this way, features bring meaning (what Giddens calls "signification") and control ("domination") to group interaction (see Orlikowski and Robey 1991). A given advanced information technology can be described and studied in terms of the specific structural features that its design offers, but most systems are really "sets of loosely bundled capabilities and can be implemented in many different ways" (Gutek et al. 1984, p. 234). This variety of possible implementations differentiates advanced information technologies from their more traditional counterparts and is a driving force behind the need for new research approaches, such as AST. Because of the many possible combinations of features, a parsimonious approach is to scale technologies among a meaningful set of dimensions that reflect their social structures. Numerous dimensions for describing advanced technology structures have been proposed. For example, Silver (1991) characterizes decision support systems in terms of their relative restrictiveness. The more restrictive the technology, the more limited is the set of possible actions the user can take; the less restrictive the technology, the more open is the set of possible actions for applying the structural features. Advanced information technologies might also be described in terms of their level of sophistication. For example, DeSanctis and Gallupe (1987) have identified three general levels of GDSS: Level 1 systems provide communication support; level 2 systems provide decision modeling; and level 3 systems provide rule-writing capability so that groups can develop and apply highly specific procedures for interaction. Finally, Abualsamh, Carlin and McDaniel (1990) and Cats-Baril and Huber (1987) characterize systems based on their degree of comprehensiveness, or the richness of their structural

feature set. The more comprehensive the system, the greater the number and variety of features offered to users. Scaling structural feature sets in terms of restrictiveness, level of sophistication, comprehensiveness, or other dimensions, can be accomplished by consulting user manuals, reviewing the statements of designers or marketers of the technology, or noting the comments of people who use the technology.

The social structures of an advanced information technology also can be described in terms of their *spirit* (Poole and DeSanctis 1990). Spirit is the general intent with regard to values and goals underlying a given set of structural features. Webster defines spirit as the "general intent" of something, as in "spirit of the law," and we construe the spirit of a technology in the same sense. The spirit is the "official line" which the technology presents to people regarding how to act when using the system, how to interpret its features, and how to fill in gaps in procedure which are not explicitly specified. The spirit of a technology provides what Giddens calls "legitimation" to the technology by supplying a normative frame with regard to behaviors that are appropriate in the context of the technology. It also can function as a means of signification, because it helps users understand and interpret the meaning of the technology. Spirit can also contribute to processes of domination, because it presents the types of influence moves to be used with the technology; this may privilege some users or approaches over others.

Spirit is a property of the technology as it is presented to users. It is not the designers' intentions—these are reflected in the spirit, but it is impossible to wholly realize their intents. Nor is the spirit of the technology the user's perceptions or interpretations of it—these give us indications of the spirit but are likely to capture only limited aspects. Spirit can be identified by treating the technology as a "text" and developing a reading of its philosophy based on analysis of: (a) the design metaphor underlying the system (e.g., "electronic chalkboard"); (b) the features it incorporates and how they are named and presented; (c) the nature of the user interface; (d) training materials and on-line guidance facilities; and (e) other training or help provided with the system. Usually the best person to make this reading is the researcher, who is able to consult with designers, investigate the structure of the software, analyze training materials, study manners of implementation, consider a range of typical user interpretations, and triangulate among these sources of evidence. The researcher should consider the interpretations of the spirit by users and designers insofar as these can be used to crosscheck conclusions drawn

from analysis of artifacts. It is important to consider multiple sources of evidence to yield an interpretation of the spirit. No one source should be considered privileged.

The use of multiple sources of evidence lays open the possibilities of contradictions; when these occur it suggests that the system in question does not present a coherent spirit. For example, some technologies may present a clear, consistent spirit, whereas others may not. The spirit is thus a variable for differentiating advanced information technologies. A coherent spirit would be expected to channel technology use in definite directions. An incoherent spirit would be expected to exert weaker influence on user behavior. An incoherent spirit might also send contradictory signals, making use of the system more difficult.

The nature of the spirit of technology can be further illuminated by exploring the analogy to legal governance. Government institutions provide systems of law that can be described both in terms of their letters (e.g., statutes), which detail specific rules and resources for social action, and their spirit, which is the historical consensus about values and goals that are appropriate (or legitimate) in society. At any given point in time, people may apply the letter of the law in ways that are consistent or inconsistent with the spirit of the law. In other words, spirit has the potential to be violated even as the letter of the law is further developed or invoked. Whereas the letter of the law—like the features of a technology—can be described in relatively objective terms, spirit is more open to competing interpretations. Early on, when a technology is new, the spirit of a technology is in flux; spirit is put forth by the designers and is evident in their pronouncements (e.g., through manuals or marketing literature) about the values and goals of the system and how it “should” be used. Organizations that subsequently adopt the technology further contribute to the definition of the spirit (e.g., through management pronouncements about the purposes of the system or through training programs). Once the technology is stable in its development and used in routine ways, the definition of spirit becomes more stable; the spirit is less open to conflicting interpretations. For purposes of structural analysis, spirit can be treated as the status quo, the researcher’s current interpretive account (based on multiples sources of evidence) regarding the values and goals of the technology.

When considering spirit we are more concerned with questions like, “What kind of goals are being promoted by technology?” or “What kind of values are being supported?” than we are with questions like

Table 2 Example Dimensions for Characterizing the “Spirit” of an Advanced Information Technology’s Social Structures

Dimension	Description (reference)
Decision Process	the type of decision process that is being promoted; for example, consensus, empirical, rational, political, or individualistic (Rohrbaugh 1989)
Leadership	the likelihood of leadership emerging when the technology is used; whether a leader is more likely or less likely to emerge, or whether there will be equal participation versus domination by some members (Huber 1984)
Efficiency	the emphasis on time compression, whether the interaction periods will be shorter or longer than interactions where the technology is not used (DeSanctis and Gallupe 1987)
Conflict Management	whether interactions will be orderly or chaotic, lead to shifts in viewpoints or not, or emphasize conflict awareness or conflict resolution (Dennis et al. 1988)
Atmosphere	the relative formality or informal nature of interaction, whether the interaction is structured or unstructured (Dennis et al. 1988, Mantei 1988)

“What does the system look like?” or “What modules does it contain?” Table 2 gives possible dimensions for characterizing the spirit of advanced information technologies, particularly GDSSs. For example, a GDSS may have a definable spirit with regard to the type of decision process that is promoted in a group; a certain style of leadership might be promoted by the system; or the value of efficiency might be emphasized. DeSanctis et al. (in press-b) provide a method for scaling the structural features and spirit of a GDSS based on both designer and user perspectives.

Together, the spirit and structural feature sets of an advanced information technology form its *structural potential*, which groups³ can draw on to generate particular social structures in interaction. For example, a restrictive, level 2 GDSS with a spirit of high formalism and efficiency might be expected to promote a parsimonious, step-by-step, data-oriented approach to group decision making. Group members might be expected to stick closely to the agenda and procedures provided by the GDSS, with little room to diverge from the prescribed approach or to invoke decision structures other than those embedded in the GDSS. On the other hand,

a less restrictive, level 1 system with an informal spirit might lead to a looser application of the GDSS structures to the decision process, with a relaxed atmosphere and a mixture of GDSS and other structures appearing in the group's interaction. In sum, we propose the following with regard to advanced information technologies (AITs):

P1. *AITs provide social structures that can be described in terms of their features and spirit. To the extent that AITs vary in their spirit and structural features sets, different forms of social interaction are encouraged by the technology.*

3.2. Other Sources of Structure

Advanced information technologies are but one source of structure for groups. The content and constraints of a given work *task* are another major source of structure (McGrath 1984, Poole, Seibold and McPhee 1985). For example, if alternative projects are being prioritized for budgeting purposes, then information about these projects and standard organizational procedures for computing budgets are important resources and rules for participants as they undertake the prioritization task. Similarly, the *organizational environment* provides structures. For example, current pressures to reduce spending or circumstances that favor certain projects over others may be brought into interaction as participants confront a budgeting task. Corporate information, histories of task accomplishment, cultural beliefs, modes of conduct, and so on, all provide structures that groups can invoke, in addition to the advanced information technology.

The structures provided by a technology may be used directly, but more likely they are invoked in combination with other structures. The array of alternative structures available to groups can affect which technology structures are selected for use, how the results are interpreted, and how they are applied. AST is consistent with contingency theories in proposing that use of advanced information technologies may vary across contexts:

P2. *Use of AIT structures may vary depending on the task, the environment, and other contingencies that offer alternative sources of social structures.*

So the major sources of structure for groups as they interact with an advanced information technology are: the technology itself, the tasks, and the organizational environment (see Table 3). As these structures are applied, their outputs become additional sources of structure. For example, after the group enters data into the GDSS, the information generated by the system

becomes another source of social structures. Similarly, information generated by applying task knowledge or environmental knowledge constitutes a source of social structures. In this sense, there are emergent sources of rules and resources upon which people can draw as social action unfolds.

P3. *New sources of structure emerge as the technology, task, and environmental structures are applied during the course of social interaction.*

3.3. GDSSs in Action

The act of bringing the rules and resources from an advanced information technology or other structural source into action is termed *structuration*. Structuration is the process by which social structures (whatever their source) are produced and reproduced in social life. For example, suppose that a GDSS provides brainstorming and notetaking techniques (level 1 features, with low comprehensiveness) which are highly flexible in their application (low restrictiveness) and that these features are presented as promoting a spirit of efficiency and democratic participation. Structuration occurs when a group applies the brainstorming and notetaking techniques to their meeting, or strives for a spirit of efficiency or democracy.

When the social structures of the advanced information technology are brought into action, they may take on new forms. That is, interpersonal interaction may reflect rules and resources that are modified from the advanced information technology. For example, when a group uses voting rules built into a GDSS, it is employing the rules to act, but—more than this—it is reminding itself that these rules exist, working out a way of using the rules, perhaps creating a special version of them. In short, the group is producing and reproducing the GDSS rules for present and future use. Use and reuse of technology structures or emergent forms of technology structures lead, over time, to their institutionalization. When the technology structures become shared, enduring sets of cognitive scripts then the structural potential of the GDSS has brought about organizational change. Technology-triggered organizational change thus takes time to occur, as technology structures are produced and reproduced in interaction.

For analytic purposes, we can capture the structuration process by isolating a group's application of a specific technology-based rule or resource within a specific context and at a specific point in time. We will call the immediate, visible actions that evidence deeper structuration processes *appropriations* of the technology (Ollman 1971). By examining appropriations, we

Table 3 Major Sources of Structure and Examples of Each

Structure Source	Definition	Examples in GDSS Context
AIT (A)	advanced information technology including hardware, software, and procedures	keyboard input devices, viewing screens, group notetaking, voting modules, decision models
AIT outputs (AO)	data, text, or other results produced by the AIT software following input by group members	displays of group votes, lists of ideas, opinion graphs, modeling results
Task (T)	task knowledge or rules; includes facts and figures, opinion, folklore, or practice related to the task at hand	a budget task, customary ways of preparing budgets, specific budget data, budgeting goals and deadlines
Task outputs (TO)	the results of operating on task data or procedures; the results of completing all or parts of a task	budget calculations; the implications of certain budget figures for other budget categories
Environment (E)	social knowledge or rules of action drawn from the organization or society at large	applying a "spread the wealth" principle to budget allocation; applying a "majority rule" decision procedure to votes; reference to corporate spending and reporting policies
Environmental outputs (EO)	the results of applying knowledge or rules drawn from the environment	implications of corporate spending policies for the budget process; the results and implications of applying a "majority rule" decision procedure to votes that have been taken

can uncover exactly how a given rule or resource within a GDSS, for example, is brought into action. Appropriation of GDSS structures is evidenced as a group makes judgments about whether to use or not use certain structures, directly uses (reproduces) a GDSS structure, relates or blends a GDSS structure with another structure, or interprets the operation or meaning of a GDSS structure. GDSS structures become stabilized in group interaction if the group appropriates them in a consistent way, reproducing them in similar form over time. In the same vein, the group may intentionally or unintentionally change GDSS structural features as it uses them; reproduction does not necessarily imply replication. For example, a group with a strict hierarchy of authority might blend the voting module of an otherwise egalitarian-oriented GDSS with a structure of leader-directed choice. The leader might state his or her position and then direct others to vote in its favor. Consequently, the voting feature of the GDSS, when brought into action, is changed from a mechanism for equal input to a mechanism for reinforcing leader directives.

In sum, the social structures available within advanced information technologies provide occasions for the structuring of action. As technology structures are applied in group interaction, they are produced and reproduced. Over time, new forms of social structure may emerge in interaction; these represent reproductions of technology structures, or blendings of technol-

ogy-based with other structures (e.g., task and environment). Once emergent structures are used and accepted, they may become institutions in their own right and the change is fixed in the organization.

P4. New social structures emerge in group interaction as the rules and resources of an AIT are appropriated in a given context and then reproduced in group interaction over time.

Appropriation and decision making processes. Appropriations are not automatically determined by technology designs. Rather, people actively select how technology structures are used, and adoption practices vary. Groups actively choose structural features from among a large set of potentials. At least four aspects of appropriation can be identified that illustrate variation in interaction processes. (In §4.1 we outline an approach for analyzing these appropriation processes.) First, groups may choose to appropriate a given structural feature in different ways, invoking one or more of many possible *appropriation moves*. Given the availability of technology structures, groups may choose to: (a) directly use the structures; (b) relate the structures to other structures (such as structures in the task or environment); (c) constraint or interpret the structures as they are used; or (d) make judgments about the structures (such as to affirm or negate their usefulness). Second, groups may choose to appropriate technology

features *faithfully* or *unfaithfully*. The features are designed to promote the technology's spirit, but they are functionally independent and may be appropriated in ways that are not faithful to the spirit. Faithful appropriations are consistent with the spirit and structural feature design, whereas unfaithful appropriations are not. Unfaithful appropriations are not "bad" or "improper" but simply out of line with the spirit of the technology. Third, group members may choose to appropriate the features for different *instrumental uses*, or purposes. For example, the group might use a GDSS to accomplish task activities, manage communication and other group processes, or to exercise power or influence (DeSanctis et al. 1992). The appropriation concept includes the intended purposes, or meaning, that groups assign to technology as they use it. By identifying instrumental uses we can begin to understand not only what structures are being used and how they are being used, but also why they are being used—the reasons or purposes for which groups elect to bring technology or other structures into action. A fourth aspect of appropriation is the *attitudes* the group displays as technology structures are appropriated, such as: (a) the extent to which groups are confident and relaxed in their use of the technology (comfort); (b) the extent to which groups perceive the technology to be of value to them in their work (respect); and (c) their willingness to work hard and excel at using the system (challenge) (Billingsley 1989; Sambamurthy 1990; Zigurs, DeSanctis and Billingsley 1990). These attitudes set the tone for applications of the technology and, in some measure, whether the group pursues its applications with sufficient vigor and confidence to carry them off. Sambamurthy (1990) found that these three attitudes significantly influenced the number of premises considered by planning groups conducting a stakeholder analysis using a GDSS.

Appropriation processes may be subtle and difficult to observe, but they are evidenced in the interaction that makes up group decision processes; appropriations are, in essence, the "deep structure" of group decision making. How group members appropriate structures from technology or other sources will influence the decision processes that unfold.

Decision theorists argue that advanced information technologies, particularly GDSSs, are designed to overcome common difficulties, or "process losses," associated with group interaction. The assumption is that use of GDSS features, such as input and exchange of ideas, computation and display of group member opinions, and quantitative decision models, will improve the processes and outcomes of group decision making

(DeSanctis and Gallupe 1987, Huber 1984). Decision process improvements include, for example, expanded *idea generation* (Nunamaker, Applegate and Konsynski 1988), more even *participation* by members in expressing their opinions (Dennis et al. 1988), more effective *conflict management* behavior (Poole et al. 1991), more even *influence* by participants on the ultimate choices made by the group (Zigurs, Poole and DeSanctis 1988), and greater focus on the *task* relative to social concerns (McLeod and Liker 1989). Improvements in these decision processes are expected to lead to desirable outcomes, such as *efficient* identification of choices (Nunamaker, Vogel and Konsynski 1989), accurate choices or high *quality* solutions (Bui and Sivasankaran 1990), high group *consensus* (Watson et al. 1988), and strong *commitment* to implementing the group decision (Dennis et al. 1988). To the extent that appropriations of technology structures vary over time or across groups, decision processes and outcomes will vary as well. Desired decision processes and outcomes are not guaranteed.

P5. *Group decision processes will vary depending on the nature of AIT appropriations.*

Factors influencing the appropriation of structures. Although appropriation processes may not always be conscious or deliberate (Barley 1990), groups make active choices in how technology or other structures are used in their deliberations. A given structure may be appropriated quite differently depending on the group's internal system, which is the nature of members and their relationships inside the group (see Homans 1950). Factors that might influence how a group appropriates available structures include:

- Members' style of interacting. For example, an autocratic leader may introduce and use technology structures very differently than a democratic leader (DeSanctis et al. in press-c; Hiltz, Turoff and Johnson 1981). Other stylistic differences, such as differences in group conflict management styles, may also influence appropriation processes (Poole et al. 1991).
- Members' degree of knowledge and experience with the structures embedded in the technology. For example, understanding of possible pitfalls and pratfalls in the structures may contribute to more skillful use by certain members (DeSanctis et al. 1992, Poole et al. 1991).
- The degree to which members believe that other members know and accept the use of the structures. The better known the structure is, the less members may deviate from the typical form of use (Vician et al.

1992). This is consistent with the notion of “critical mass” whereby the perceived value of a technology shifts as it spreads rapidly through a community; later adopters are influenced by the values and behaviors of earlier adopters and vice versa (Markus 1990).

- The degree to which members agree on which structures should be appropriated. There may be uncertainty about which structures are most appropriate for the given situation or power struggles over which structural features should be used. Greater agreement on appropriation of structures should lead to more consistency in the group’s usage patterns (Poole, DeSanctis, Kirsch and Jackson 1991).

These assumptions imply the following proposition:

P6. The nature of AIT appropriations will vary depending on the group’s internal system.

Appropriation and decision making outcomes. The model presented in Figure 1, which summarizes the relationships discussed in this section, has important implications for the study of AIT effects on organizational change. A major implication of P1 through P6 is that clearcut predictions about how AIT structures will be appropriated, or what the ultimate outcomes of that appropriation will be, are difficult to formulate. The structural features of the technology, along with the task, the organizational environment, and the group’s internal system, act as opportunities and constraints in which appropriation occurs. In general, we would expect desired decision processes to be more likely to result when appropriation patterns take on the following properties: (a) appropriations are faithful to the system’s spirit, rather than unfaithful; (b) the number of technology appropriation moves is high, rather than low; (c) the instrumental uses of the technology are more task or process-oriented, rather than power or exploratory-oriented; and (d) attitudes toward appropriation are positive, rather than negative. These constitute an idealized profile of appropriation by the group. To the extent that appropriation diverges from this ideal, desired group decision processes may not occur. Improvement in decision outcomes, in turn, will emerge only if the group’s decision processes are suitable for the task at hand (e.g., greater participation and productive information sharing for idea generation tasks; systematic reasoning and resolution of stakeholder conflicts for planning tasks). Thus there is a “double contingency”:

P7. Given AIT and other sources of social structure, $n_1 \cdots n_k$, and ideal appropriation processes, and deci-

sion processes that fit the task at hand, then desired outcomes of AIT use will result.

If group interaction processes are inconsistent with the structural potential of the technology and surrounding conditions, then the outcomes of group use of the structures will be less predictable and, on the whole, less favorable. There is a dialectic of control (Giddens 1979) between the group and the technology; technology structures shape the group (P1), but the group likewise shapes its own interaction (P6), exerting control over use of technology structures and the new structures that emerge from their use (P3). Organizational change occurs gradually, as technology structures are appropriated and bring change to decision processes. Over time, new social structures may become a part of the larger organizational life (P4). The change is evidenced in group decision processes (e.g., methods of idea generation, participation, or conflict management). In this way, advanced information technologies can serve to trigger organizational change, although they cannot fully determine it.

4.0. The Analysis of Structuration in GDSS Use

The AST perspective of technology and organizational change implies a research agenda that investigate all aspects of the model presented in Figure 1. To illustrate such an agenda we will consider GDSSs in a small group context, but our analytic strategy could be applied to other advanced information technologies and settings as well. Figure 2 summarizes our proposed strategy. Steps 1 through 10 in the figure represent a diachronic analysis of structuration, examining the developmental path of technology use for a given group over time. The diachronic analysis can be repeated for different types or levels of technology support, yielding a synchronic analysis. For example, we might compare group interaction processes with GDSS versus no GDSS support, or GDSS versus some manual form of support; level 1 versus level 2 types of GDSS support could be compared as well. In the same way, the diachronic analysis can be applied to compare groups or clusters of groups within or between organizations, yielding parallel analyses. Diachronic, synchronic, and parallel analyses are important, complementary approaches to understanding technology-triggered organizational change (Barley 1990). A complete research agenda should include all of these approaches. Diachronic analysis is particularly crucial to understanding the adaptive process by which technology

Figure 1 Summary of Major Constructs and Propositions of AST

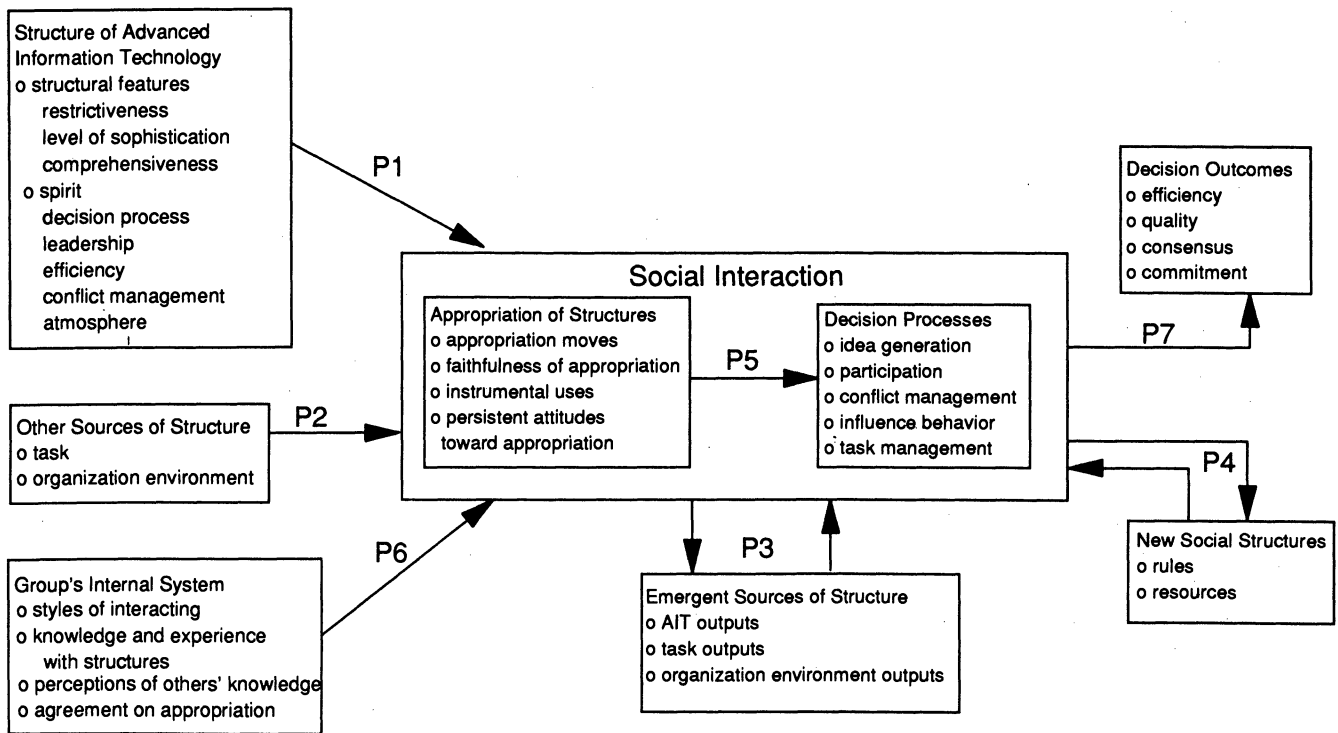
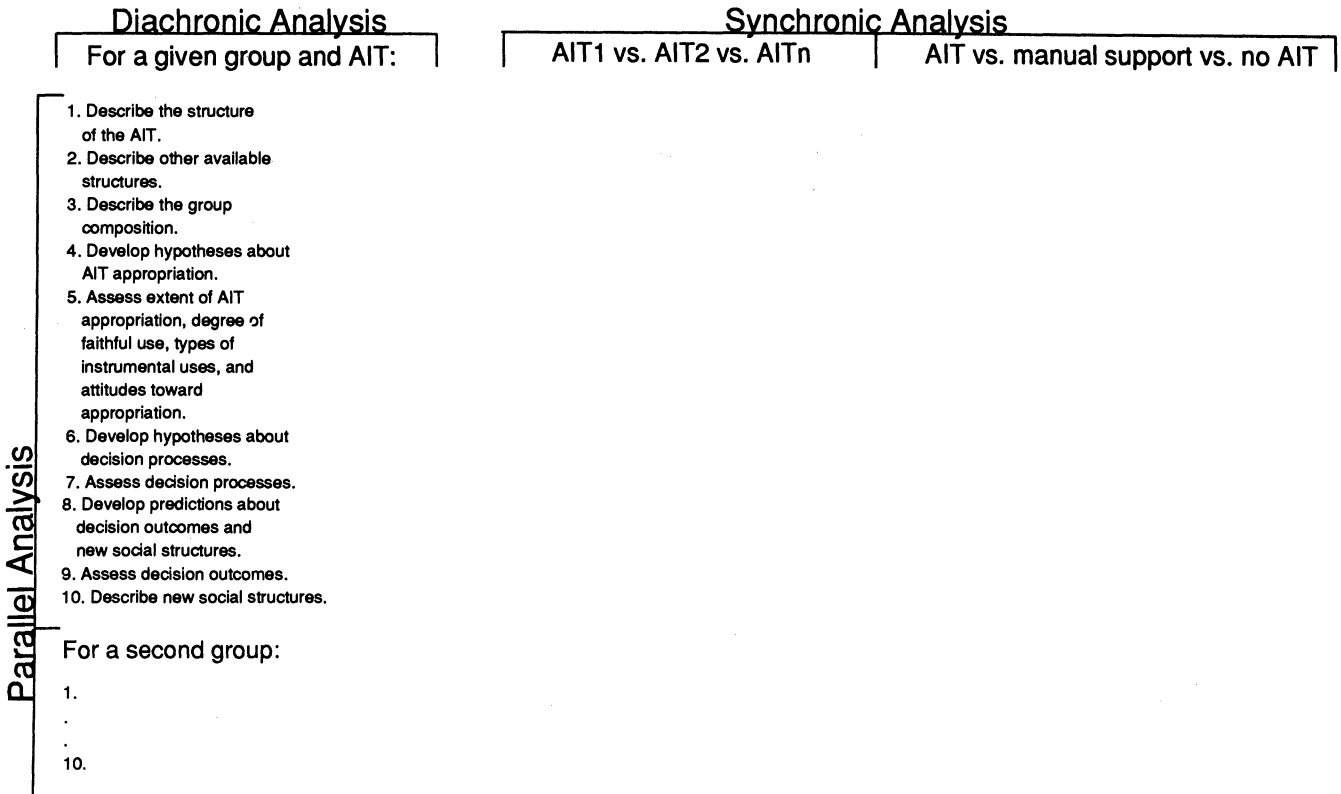


Figure 2 General Analytic Strategies for Assessing the Constructs and Propositions of AST



structures are incorporated into interaction, so we will focus on diachronic techniques in detail and provide an illustration of how such an analysis might be undertaken.

4.1. Diachronic Analysis

For a given group and technology, a clear understanding of the structural features and spirit of the technology must first be articulated (Figure 2, step 1). This understanding can be gleaned from manuals, discussions with designers, observation of the system itself, reports from users, and so on. Such a description should be more systematic than a simple description of functions or interface characteristics; it should scale the technology along meaningful, comparable dimensions (such as those in Figure 1 and Table 2) that reflect the spirit and the structural feature set. A careful analysis of the structure of the technology yields information about the kinds of social interaction and outcomes that the technology is likely to promote. Silver (1991) and DeSanctis et al. (in press-b) illustrate how decision support technologies can be described in structural terms.

Other sources of structures can be similarly described (Figure 2, step 2). For example, what social structures are provided by the task(s) the group confronts? And what structural potentials exist within the organizational environment? Tasks can be described in terms of complexity, richness, or conflict potential (McGrath 1984). The organizational environment might be scaled in terms of complexity, formalization, or democratic atmosphere (Collins, Hage and Hull 1988). By scaling sources of social structure along a meaningful set of dimensions, hypotheses about the degree of "fit" between technology and other sources of structure can be identified. Most likely, high task-technology fit will be associated with greater AIT appropriation moves, more faithful appropriation, and more positive attitudes toward appropriation. Assessment of the group's internal system, such as their degree of experience in working together or with the AIT, their dominant style of leadership, or their agreement with respect to the purpose of the AIT or how it should be used, can also lead to hypotheses about AIT appropriation (step 3). For example, in the case of a GDSS, greater experience with using the technology, greater agreement about how the system should be used, and a more participative style on the part of the leader, might be expected to lead to greater and more faithful appropriation moves (step 4).

Assessment of appropriation processes is at the heart of the analysis (step 5 in Figure 2). Appropriation

analysis tries to document exactly how technology structures are being invoked for use in a specific context, thus shedding light on the more long-term process of adaptive structuration (i.e., the formation of new social structures). Discourse is the object of study. AST follows the tradition of structuralism in assuming that language is reflective of cultural evolution and can be investigated scientifically (Thompson 1981). Conversations, announcements, documents, and all forms of written and spoken speech are of potential interest to the investigator. Appropriation analysis examines how technology and other sources of social structure are brought into human interaction through discourse. Such an analysis can be undertaken at one of three general levels: micro, global, or institutional. At each level, the four aspects of appropriation identified earlier can be examined: (a) appropriation moves, (b) faithfulness of appropriation, (c) instrumental uses, and (d) attitudes toward appropriation. Appropriation analysis can logically begin at the microlevel, since it is in specific instances of discourse that the formation of new social structures begins. Written or spoken discussion about the technology is particularly important since this is evidence of people bringing the technology into the social context. From there, appropriation analysis can proceed to higher levels, global and institutional. The researcher can proceed from a microlevel, then to a global level, and finally to an institutional level of analysis, progressively investigating more and more strata of the technology's role in organizational change. Lower levels of analysis help to explain changes that eventually are evident at the institutional level. Further, lower levels of analysis can help to explain why technology brings change in some contexts (e.g., in some groups) but not in others. Over time, institutional-level appropriation affects micro-level appropriation, and vice versa. Engaging in multiple levels of analysis can yield ideas for improving technology designs or the conditions under which they are used. Table 4 shows how appropriation analysis for AIT structures might be undertaken at the three levels.

4.1.1 Microlevel analysis. examines the appropriation of technology structures as it occurs in sentences, turns of speech, or other specific speech acts. In the case of GDSS use, microanalysis might study the speech acts of group members, or sequences of speech acts, that occur during a computer-supported meeting. To make the analysis systematic, the range of possible appropriations can be identified and speech acts then classified according to that scheme. An a priori set of possible appropriations of technology structures cues

the observer on “what to look for”; the interpretive demands of the research, though not eliminated, are substantially reduced. Table 5 illustrates a straightforward approach to identifying group response to AIT and other structures, starting with the four general types of appropriation moves identified earlier and then describing subtypes within each of these. Any given speech act in the group may include one or more of these appropriation moves. For example, consider an excerpt of discourse among five people who are using a GDSS in a face-to-face meeting, as shown in Table 6(a). Each move to appropriate structures can be described in terms of the source of structure (Table 3)

Table 4 Three Levels of Appropriation Analysis for AIT Structures

Level of Analysis	Unit of Analysis	Aspects of Appropriation
Micro	speech or other acts	appropriation moves (types and subtypes); faithful vs. unfaithful appropriation;
	meeting phases	instrumental uses of structures; attitudes toward structures
Global	entire meeting	dominant appropriation moves; degree of faithful appropriation; dominant instrumental uses; persistent attitudes toward structures;
	multiple meetings	relatively stable patterns of appropriation, in terms of moves, degree of faithful use, instrumental uses, and attitudes
Institutional	multiple groups	predominant types of moves in the business unit or type of user group; degree to which faithful use is widespread; typical instrumental uses among the studied groups; dominant attitudes;
	across organizations	commonalities and differences in appropriation moves, faithful use, instrumental uses, and attitudes across organizations

and the appropriation type and subtype (Table 5). In this way, actual appropriation of structures can be documented as they occur in discourse. New structures that emerge in the group, such as outputs generated by use of the technology or the results of applying task knowledge, can also be noted and their appropriation documented. For an example, see Table 6(b). The goal is to identify (a) what structures are being appropriated and (b) how they are being appropriated. Interpretive schemes, such as those in Tables 5 and 6 make the analysis systematic and allow comparisons of appropriation over time or across groups.

Note that our interpretive scheme includes a distinction between faithful and unfaithful appropriation of structures. Within the interpretive scheme in Table 5, an unrelated substitution (2c) and a paradoxical combination (3b) are unfaithful appropriations. Unfaithful appropriations are judged by reference to the spirit of the technology; combinations which meld structures that are incompatible with each other or with the spirit are unfaithful. Unfaithful appropriations are important to track because they help to explain how technology structures do not always bring the outcomes that designers intended. Instrumental uses that technology structures serve for the group can also be examined at the microlevel. For example, Table 7 outlines possible instrumental uses that we have observed in our studies of GDSS use (e.g., DeSanctis et al. 1992, in press-a). Instrumental uses are not always obvious in just a few speech acts. Typically these are revealed through analysis of meeting phases, or extended periods of discourse. For example, in the illustration given in Table 6(a), the instrumental use appears to be task-oriented; the group is using the GDSS voting function as a means of assessing member priorities on projects. There may be multiple instrumental uses implied in any one phase of technology use, and several types of uses may occur over the course of an entire meeting.

The fourth aspect of microlevel analysis is the attitudes the group displays as technology structures are appropriated. Three important attitudes that we have studied in our research are the extent to which groups are comfortable, value, and feel challenged as they appropriate the technology. (See §3.3 for definitions of these attitudes.) These or other attitudes of interest can be measured via observer ratings or retrospectively via self reports of group members. (See Billingsley 1989 and Sambamurthy 1990 for examples.)

In sum, microlevel appropriation analysis consists of identifying types of appropriation moves, distinguishing between faithful and unfaithful appropriation, and examining the instrumental uses and attitudes group

Table 5 Summary of Types and Subtypes of Appropriation Moves

Appropriation Moves	Types	Subtypes	Definition
Direct Use (structure is preserved)	1. Direct appropriation	a. explicit	openly use and refer to the structure
		b. implicit	use without referring to the structure (e.g., typing)
Relate to Other Structures (structure may be blended with another structure)	2. Substitution	c. bid	suggest use of the structure
		a. part	use part of the structure instead of the whole
	3. Combination	b. related	use a similar structure in place of the structure at hand
		*c. unrelated	use an opposing structure in place of the structure at hand
		a. composition	combine two structures in a way consistent with the spirit of both
	4. Enlargement	*b. paradox	combine contrary structures with no acknowledgement that they are contrary
		c. corrective	use one structure as a corrective for a perceived deficiency in the other
		a. positive	note the similarity between the structure and another structure via a positive allusion or metaphor
	5. Contrast	b. negative	note the similarity between the structure and another structure via a negative allusion or metaphor
		a. contrary	express the structure by noting what it isn't, that is, in terms of a contrasting structure
b. favored		structures are compared, with one favored over the others	
c. none favored		structures are compared, with none favored over the others	
d. criticism		criticizing the structure, but without an explicit contrast	
Constrain the Structure (structure is interpreted or reinterpreted)	6. Constraint	a. definition	explaining the meaning of the structure or how it should be used
		b. command	giving directions or ordering others to use the structure
	7. Affirmation (structure is accepted)	c. diagnosis	commenting on how the structure is working, either positive (+) or negative (-)
		d. ordering	specifying the order in which structures should be used
		e. queries	asking questions about the structure's meaning or how to use it
		f. closure	show how use of a structure has been completed
		g. status report	state what has been or is being done with the structure
		h. status request	question what has been or is being done with the structure
		a. agreement	agree with appropriation of the structure
		b. bid agree	ask others to agree with appropriation of the structure
8. Negation (structure is rejected or ignored)	c. agree	others agree to reject appropriation of the structure	
	d. compliment	note an advantage of the structure	
	a. reject	disagree or otherwise directly reject appropriation of the structure	
9. Neutrality	b. indirect	reject appropriation of the structure by ignoring it, such as ignoring another's bid to use it	
	c. bid reject	suggest or ask others to reject use of the structure	
		expressing uncertainty or neutrality toward use of the structure	

*These represent unfaithful appropriations. All others are faithful appropriations.

Table 6(a) An Illustration of Microlevel Analysis of Appropriation

Sources of Structure ¹	Appropriation Move ^{2,3}	Group Member	Speech or Other Action	Explanation of Appropriation Move
A-T	3a	3	Well, look — let's vote, let's vote on our priorities for these projects.	The voting feature of the GDSS combined with the prioritization goal of the budgeting task.
A	1c	1	Why don't we use the voting facility...	A suggestion is made to use a structural feature of the GDSS.
A	8b	3	(interrupting) Let's rank the alternatives and then vote.	Member 1's suggestion is ignored and an order for using the GDSS structures is proposed.
A	6d			
A	7a	5	OK, let's rank them.	Member 5 agrees with the appropriation move made by member 3.
A	8c	2	I don't see why we are ranking the alternatives	Member 2 disagrees with the appropriation move and asks others to reject it.
A	6b	3	Just — everyone go ahead and do it.	Member 3 commands member 2 to follow the appropriation move.
A	6c(-)	2	I still haven't got an answer to my question	The proposed appropriation move is criticized.
A	6h	2	Are we ranking the alternatives?	A query on what is being done with the GDSS structure.
A-T	5d	4	We already know — I already know what everyone's priorities are on these projects.	The idea of using the GDSS to do the task is criticized.
A	6a	5	Because the software is built for this.	An explanation for the proposed appropriation of the GDSS is given.
A	6a	3	We don't know everybody — somebody might be thinking differently than... you know... (fades)	Further justification of the appropriation move is given.
A-T	5b	2	What is this going to show us that we don't already have in the budget proposals?	The GDSS and task structures are compared, with the task information favored.
A	6a	3	Not everybody is voicing their opinions, and I want to clarify exactly where everyone stands.	An explanation for the proposed appropriation of the GDSS is given.
A	1b	all	(everyone inputs / keys into the GDSS)	Group members use the GDSS.

¹A refers to the advanced information technology, in this case a GDSS. T refers to the task. See Table 3.

²See Table 5 for definitions of appropriation moves.

³Note that categorization of appropriation moves is made not only on the basis of the text transcript of the group's interaction, but also on listening to the discourse and observing the group. Hence, inferences about the intent of the speaker are being made.

members apply to technology structures. Appropriation moves associated with individual speech acts, when compiled across meeting phases or entire meetings, may reveal dominant patterns of appropriation in the group. (For an illustration, see Poole and DeSanctis 1992.)

4.1.2. Global level appropriation. By identifying the most persistent types of appropriation moves made by

a group over a period of time, microlevel appropriation analysis can be extended into the global level of analysis. Global analysis examines conversations, meetings, or documents as a whole, rather than isolating the specific acts within them. In the GDSS setting, global level analysis might consider appropriation across the course of an entire meeting, or a series of meetings. This can be done by collapsing data obtained from speech acts or multiple meeting phases over long peri-

Table 6(b) An Illustration of Microlevel Analysis of the Outputs of Appropriation

Sources of Structure ¹	Appropriation Move ²	Group Member	Speech or Other Action	Explanation of Appropriation Move
AO	1a	3	OK (looking at votes on large screen), so two of us are adamantly against funding the Pierson plan, but on all the other projects we basically agree.	The outputs of the GDSS are explicitly used.
AO	7a	5	That's right.	Member 5 agrees with the appropriation of the AO structure.
T	1a	2	The Pierson plan is the most researched and carefully planned proposal I've seen in a long time. Look at the customer support figures on page 5.	Task information and materials are explicitly used and referred to.
T	1b	all	(all look at documents; silence and shuffling of paper)	There is implicit use of the task structures.
T	8a	4	I don't know,	Disagreement with Member 2's appropriation of the task reference to a structure of the organization (what is generally done and not done).
E	1a	4	it's just not done around here. The idea of using customer-based incentives is against our corporate policy, in my opinion.	
EO	8a	2	Not if you apply the policy to include potential customers, not just existing customers.	Member 2 applies the outputs of external (organization) structure to disagree with the appropriation of the external structure.

¹AO refers to outputs of the advanced information technology, in this case a GDSS. T refers to the task. E refers to the external environment. EO refers to outputs from use of an external structure. See Table 3.

²See Table 5 for definitions of appropriation moves.

ods of time. Alternatively, segments of interaction can be studied at systematic intervals, such as the start, middle, or end of each meeting, or throughout a sampling of meetings. The goal here is to identify systematic patterns in the way a given group appropriates technology structures, including dominant appropriation moves (types and subtypes), degree of faithful or unfaithful appropriation, and the instrumental uses and attitudes associated with the appropriation process.

Some previous research has attempted to identify global appropriation. For example, DeSanctis et al. (1992) identified three types of appropriation patterns based on instrumental uses across multiple meetings of seven groups using a GDSS: (a) pure task and process groups, (b) social and power-oriented groups, and (c) mixed groups. The group's dominant type of instrumental use was found to relate to: their overall amount

of GDSS use; who initiated system use in the group; observers' ratings of group comfort toward the technology; and members' expressed sentiments toward the system as they used it. Billingsley (1989) has developed a method for coding global appropriations from group interaction with a GDSS. Her coding process involves two "sweeps" through videorecordings of meetings. In the first sweep, coders classify one-minute segments of interaction for: (a) the specific task for which the group is using the GDSS; and (b) whether the use in question is faithful or unfaithful. In the second sweep, 15-minute segments are coded for: (c) degree of challenge and (d) comfort with the system.

4.1.3. Institutional level appropriation. Appropriation analysis at the level of the institution as a whole requires longitudinal observation of discourse about the technology, with the goal of identifying persistent

Table 7 Instrumental Uses, or Functions, of AIT Appropriation

Instrument Use	Definition	Includes	Does Not Include
Task	Use of the AIT to facilitate substantive work on agenda-setting, problem definition, solution generation, or other task-related operations	uses where the group first decides the activity they will undertake, then moves to the AIT to facilitate accomplishment of the activity	uses where the group looks to the AIT to determine how they should proceed.
Process	Use of the AIT to manage communication and other group processes	where the group is on a tangent, or floundering about how to proceed and then looks to the AIT to help them decide how to proceed	where the group first decides an activity, or how to proceed, and then looks to the AIT to accomplish the activity
Power	Use of the AIT by a group member to influence others' thinking or to move them forward in their work	use where the user(s) deliberately intended to affect the general discussion or other's opinions	use which is not intended to influence the group
Social	Use of the AIT to establish or maintain social relationships among members, such as to joke, laugh, or tease one another	laughing and joking together while entering information on the AIT or discussing outputs; shared jokes in the context of AIT use	socializing that has not been brought about by, or directly involves, use of the AIT
Individualistic	Use of the AIT by an individual purely for private reasons, such as to take personal notes or to explore system features	individual task-related or fun/exploratory uses of the AIT	individual uses that are used to influence others (as in Power uses)
Fun/Exploratory	Use of the AIT for its own sake, with no specific goal in mind other than "play" or "understand how the system works"	laughing at incorrect or inept uses; using the AIT to make others laugh; most or all members are involved	exploratory uses that are conducted by one person (as in Individualistic)
Confusion	Use of the AIT during a period of disorientation, or where there is no clear focus of attention in the group	multiple conversations or simultaneous AIT uses in the group with no common goal or focus	disorientation periods where the AIT is not being used or referred to, or periods where use is clearly for fun/exploratory purposes

patterns across business units (e.g., production versus marketing), users types (e.g., management versus union; men versus women), or organizations (e.g., manufacturing versus service firms). As at other levels, the analysis aims to identify how technology structures are directly used, interpreted, combined with other structures, and so forth; but at the institutional level the goal is to identify persistent changes in behavior following introduction of the technology, such as shifts in how problems are described, decisions are made, or choices legitimated. In the case of GDSS, example questions of interest include: What kinds of tasks tend to be combined with GDSS uses in this business unit or organization? Have GDSS structures, such as a democratic spirit or specific decision techniques, been widely incorporated into organizational meetings? Are these structures being applied even when the technology is not available? Has extensive GDSS use led to increased task and process-orientation in meetings, and less socialization, fun, or confusion in meetings? Are there fewer power moves in meetings since the GDSS

has been adopted, or more? What kinds of attitudes toward the technology are being promoted in organizational training sessions? What are the dominant attitudes among users of the system? In our research we have just begun to study appropriation at the institutional level, electing instead to start with microlevel analysis. Barley (1990), Barley and Tolbert (1988), and Robey et al. (1989) provide institutional-level analyses of technology effects that would be useful to researchers interested in structuration accounts of advanced information technologies in organizations.

4.2. Analytic Strategy

In sum, assessment of appropriation processes (Figure 2, step 5), whether at the micro, global, or institutional level, can be accomplished via a procedure such as the following:

(1) Begin by documenting an interaction sequence, such as a group conversation, meeting or other time period in which the advanced information technology was present and available for use. For microlevel anal-

ysis, a verbatim transcript is needed. For global level analysis, a detailed description of the sequence of events may be sufficient. For institutional analysis, samples of conversations, memos, announcements, or other documents may be necessary.

(2) For each speech or other action, identify the group member(s) initiating the appropriation and the source(s) of the structure being appropriated, such as the AIT (A), task (T), environment (E), or an output of one of these (AO, TO, or EO) (Table 3).

(3) Classify each act into one or more interpretive categories of appropriation, such as those given in Table 5.

(4) Identify the instrumental uses of technology appropriation (Table 7); this can be done for each speech act, grouping of speech acts, or other meaningful unit of analysis.

(5) Parse the interaction sequence into meaningful phases of appropriation; these may be delineated in terms of AIT use/nonuse, faithful use/unfaithful use, task uses/nontask uses, or any other meaningful method of parsing the interaction. Descriptive observations (made by the researcher or informants) can be given for each sequence, applying the various dimensions given in Figure 1.

(6) Systematically reduce the data to a manageable form (Miles and Huberman 1984). Data reducing can take the form of deriving frequencies of interpretive categories (steps 2, 3 and 4). Even more informative is to construct a concise, qualitative map of each meeting or other segment of discourse, along the lines described by Krippendorff (1980). The map consists of a synopsis of the group's discussion on the right half of each page, with descriptions and code letters on the left half denoting phases of appropriation; code letters could be used, for example, to locate every speech act or phase involving a combination of A and E structures or extended periods of unfaithful appropriation. Poole and DeSanctis (1992) provide an illustration of this procedure at the microlevel.

(7) Identify dominant types of moves and persistent patterns of instrumental uses and attitudes for the interaction sequence of interest. This may be compiled for a single meeting, or in the case of global or higher levels of analysis, for multiple meetings or other forms of discourse. This can be done by computing summary descriptive statistics for interpretive scheme data (see DeSanctis et al. (1992) for an illustration), and/or by applying techniques proposed by Miles and Huberman (1984) for collapsing qualitative data.

These procedural steps are similar to those followed by Courtright, Fairhurst and Rogers (1989) in their

interpretive analysis of interaction patterns. Based on the patterns of appropriation that emerge in the analysis, specific hypotheses about decision processes can be developed (Figure 2, step 6). Existing approaches are available to study the group's internal system, decision processes, and decision outcomes (Figure 2, steps 7–9). For example, there are rating scales for assessing style of interaction, decision quality, and commitment (Gouran, Brown and Henry 1978); models for calculating evenness of member participation (Watson et al. 1988) and consensus (Spillman, Spillman and Bezdek 1980); and coding schemes for assessing conflict management (Poole et al. 1991), influence behavior (Putnam 1981), and task management (Poole et al. 1990). Documentation of new structure formation (Figure 2, step 10) will require longitudinal observation of the group and identification of persistent use of the technology-based structures in the group or organization at large.

4.3. An Illustration

To illustrate the use of our analytic strategy for studying appropriation, we compared two groups that used the same GDSS for prioritizing projects for organizational investment. We applied the interpretive schemes given in Tables 3, 5, and 7 to verbatim transcripts of one decision-making meeting for each group. Since the schemes account for group members' intentions with respect to interactions with others, as much as the particular words or expressions used, categorization was done using both a written transcript and an audio tape of the meeting.⁴ Consistent with Krippendorff's (1980) approach, after initial categorization and again after development of phasic maps, we met to compare results (see Gersnick (1988) for a similar approach). We discussed discrepancies until agreement could be reached, referring to the audio tapes as necessary. This process produced a final set of categorizations and a descriptive map for each meeting. Next we computed quantitative summaries of appropriation moves and developed descriptive accounts of each meeting. Samples of micro and global analyses for our two illustrative groups are shown in Figures 3(a) and 3(b). This represents a diachronic analysis for each group and a parallel analysis as groups are compared.

Following the model given in Figure 1, both groups had similar inputs to group interaction. The sources of structure and the group's internal system were essentially the same in each group, except that group 1 had a member who was forceful in attempting to direct others and was often met with resistance. Figure 4 presents descriptive summaries of our appropriation analysis for each group. Notice that group 2 spent much

Figure 3b An Illustration of Micro and Global Appropriation Analysis: Group 2.

Interaction analysis			Meeting phase analysis		
Source of structure & appropriation move	Group member	Speech or other action	Sources of structure in use	Instrumental uses of GDSS	Attitudes toward GDSS structures
AO-1c	5	Well, I don't know, let's talk about those three things.	AO A E ⓐ	task	comfort=high respect=moderate challenge=moderate
AO-7a, A-1a	4	OK, let's view selection criteria (a GDSS feature).			
A-1a	5	"define/view selection criteria"			
A-1b	all	(select menu options so that they can look at the selection criteria entered earlier)			
AO-AO-3a	1	Well, I think one and three (item numbers of criteria on the GDSS screen) are pretty much the same			
AO-7a	5	Yes, those have the two highest (weights)			
AO-8c, A-1c	1	So let's delete number one and weight them again			
AO-1e, A-8a	4	Why would you want to do that?			
AO-AO-5b	5	I think it's obvious that the majority of us feel that increasing business is more important than directly helping the community as a whole, but I think that one thing you're missing is that there is going to be a "trickle down" effect because contributions to the community come from business			
E-1a	4	yes			
E-7a	5	So reverting back to these proposed projects obviously number one, lowering taxes, is going to be beneficial not only to businesses but also			
AO-1b	5	That's if you assume there's a trickle down effect.			
AO-8a, E-1b	1	Right, don't you feel that way?			
E-7a, AO-7b	5	Not totally. To a point there is, but			
AO-8e	5	You can help some of the people some of the time but not all of the people all of the time			
E-1a	5	OK, so these are OK. We should move on to evaluating our alternatives. Maybe we should rate these projects.			
E-7a, A-1c	1				
For this passage Dominant appropriation moves proportion of A or AO moves = .74 proportion of T, E, or combination (including A with T or E) moves = .26 Number of unfaithful appropriations = 0 Dominant instrumental uses = task Dominant attitudes toward GDSS: high comfort, moderate respect, moderate challenge					
For the entire meeting (consisting of 22 passages) Dominant appropriation moves proportion of A or AO = .75 proportion of A codes devoted to constraint (5a codes): .68 proportion of T, E, or combination (including A with T or E) moves = .25 Number of unfaithful appropriations = 1 Dominant instrumental uses = task Dominant attitudes toward GDSS: moderate comfort, high respect, high challenge					

or action may carry multiple meanings, it may be classified into more than one category. Although validation might be achieved by asking informants of the scheme's adequacy, more often validity is achieved through researchers' ongoing dialectic over specific claims. Analytic criticisms of Searle's analysis of the constitutive rules for the performance of speech acts (Frank 1981; Levinson 1981) illustrate this form of theory testing. The debate over the adequacy of an interpretive scheme is advanced largely through the presentation of examples and counterexamples that illustrate potential advantages or problems. Indeed, in interpretive analyses there is an implicit belief that the knowledge the investigator is unearthing through the identification of formal properties may be beyond the informants' expressive capacity. In sum, although we can argue the validity of our interpretive schemes based on case illustrations and the scheme's ability to predict group consensus (as in Poole and DeSanctis 1992), a continued dialectic among scholars interested in appropriation analysis is perhaps more important.

Finally, it is important to keep in mind that just as technology impacts are not pure and are mediated by a complex web of forces (Kling 1980), interpretive schemes—however rich and sensitive to subtle meanings—cannot be all-encompassing. As representation schemes, they have the problems of reductionism that plague nearly all behavioral measurement. On the other hand, comprehensive, clean prediction of structural effects on interaction or behavior outcomes is not the goal. Our interest is in describing appropriation processes with sufficient refinement so that we can gain meaningful (though not perfect) insight into the connection between technology and action.

5.0. Conclusion

Business professionals, researchers, and social commentators often express disappointment with the fact that advances in computing technology have not brought about remarkable improvements in organizational effectiveness. Why is it that technology impacts

Figure 4 Sample Descriptive Analyses

Group 1

GDSS appropriation

The group relied heavily on the GDSS to direct its discussions, first consulting the GDSS features and then deciding how to proceed. Members started by defining their decision problem in the GDSS and then entered criteria for evaluating their projects. They did not use weighting, rating, or voting features to establish the relative importance of criteria. Several members confused the meaning and capabilities of the "criteria" feature in the system (3b in Table 5). There was a good deal of unrelated substitution (2c) of GDSS structures; one member in particular kept suggesting that the group use or not use GDSS structures based on faulty understanding of the system, incorrectly extrapolating from other systems or experiences (2c); at several points he directed the group to use certain features that could not accommodate their work activities. Members had problems coordinating idea entry into the GDSS; a long series of commands (6b), status requests (6h), and status reports (6g) reflected the difficulty the group had in coordinating their efforts. There were periods of high disagreement among the members (large numbers of 8a, 8b, and 8c codes), but they did not have trouble operating the system (6c-), nor did they criticize it (5d).

Decision processes and outcomes

This group used the GDSS a great deal and, although there were periods of confusion in instrumental use, members exhibited consistently positive attitudes toward the technology. Given this pattern of appropriation, we would expect the group to have fairly positive attitudes toward the GDSS at the end of the meeting, which they did. In terms of decision processes, the group was able to generate ideas readily, but because one member dominated in appropriation moves, participation was not even. Members expressed high disagreement with one another about the ideas they generated via the technology. Conflict was quite high and the group had difficulty managing its task, using the technology as an instrument of process more than for task aims. These interaction patterns led to an extremely long meeting, rather than an efficient one, and resulted in mixed feelings about the quality of the group's final decision. The group did not converge in their viewpoints as a result of their meeting, although they gained greater understanding of each other's positions on issues.

Group 2

GDSS appropriation

The group began by entering a task problem statement into the system and then using the "criteria" feature to brainstorm ways of evaluating of the projects under consideration. Next, members evaluated the criteria using a weighting scheme and discussed their agreements and disagreements about the criteria and the weight values. As in Group 1, the proportion of A and AO moves was quite high, indicating substantial appropriation of the GDSS during the meeting; however, Group 2 spent much more time defining the meaning of the system features and how they should be used relative to the task at hand (6a). Group 2 had little trouble coordinating system use and had relatively few disagreements about appropriation or unfaithful appropriations. Members stepped in readily to help each other in system operation through command-response sequences (6b followed by 7a). Rather than having the system drive the group process, members tended to first decide on a course of action and then look to the system to help execute the action. Though not always high in comfort with the technology, they exhibited high respect and a sense of challenge toward using the system. Also, there was substantial blending of system outputs (AO) with task and external structures, rather than sole discussion of one or the other.

Decision processes and outcomes

The group was agreeable and approached its task in a serious, matter-of-fact manner. They took a step-by-step approach to the decision process, first entering ideas into the GDSS and then used various voting methods to evaluate their ideas. Members brainstormed in this fashion for criteria to evaluate projects for funding. Although its decision steps were similar to Group 1, there was much greater agreement on appropriation in this group. There was less repetition, or backtracking, of steps in Group 2 as they proceeded through the decision process smoothly. Conflict was confined to critical work on differences rather than escalated argument. Two members were more dominant than others in initiating appropriation moves, making participation in the discussion somewhat uneven (with some members saying less than others). Nevertheless, there was an atmosphere of respect for differences between members, yielding a decision process that was consistent with the spirit of the GDSS. In addition to productive conflict management, the group engaged in good task management as members first discussed their objectives and decision process and then invoked the GDSS to facilitate their work. These decision processes resulted in an efficient meeting and strong post-meeting consensus.

are often more subtle than dramatic? Positive in some organizations, yet neutral or even negative in others? Fresh theoretical approaches are needed to shed new light on these old questions. Structuration models are appealing because they emphasize the interplay between technology and the social process of technology use, illuminating how multiple outcomes can result from implementation of the same technology. Because the new structures offered by technology must be blended with existing organizational practices, radical behavior change takes time to emerge, and in some cases may not occur at all. Structuration models go beyond the surface of behavior to consider the subtle ways in which technology impacts may unfold. Limitations of structuration models to date have been their weak consideration of the structural potential of tech-

nologies in general and advanced information technologies in particular, their exclusive focus on institutional levels of analysis, and reliance on purely interpretive methods. To yield useful knowledge for organizations, structuration-based theories of technology-induced change must devise detailed models of group dynamics and a set of methods for directly investigating the relationship between structure and action (Barley and Tolbert 1988). In this paper we have refined structuration concepts to the realm of advanced information technologies, integrated concepts from the decision-making school with structuration concepts, and demonstrated how structuration can be studied within an empirical program of research.

To summarize, AST argues that advanced information technologies trigger adaptive structuration pro-

cesses which, over time, can lead to changes in the rules and resources that organizations use in social interaction. Change occurs as members of organizational groups bring the structural potential of these new technologies into interaction, appropriating available structures during the course of idea generation, conflict management, and other group decision activities. Group members can opt to directly use technological features, relate the structures to other structures, constrain or interpret the structures, or make judgments about the structures. The impacts of the technology on group outcomes depend upon: the structural potential of the technology (i.e., its spirit and structural features), how technology and other structures (such as work tasks, the group's internal system, and the larger organizational environment) are appropriated by group members; and what new social structures are formed over time. Appropriations which initially occur in microlevel interaction eventually may be reproduced to bring about adoption of technology-based structures across multiple settings, groups, and organizations.

One strength of AST and the method outlined here is that they facilitate analysis of between-group differences. To determine whether advanced information technologies have the deterministic effects that decision theorists hypothesize or the emergent effects envisioned by institutionalists, it is necessary to assess whether between-group differences are significant. To us it seems most likely that there will be some variation in the strength of the two types of effects across organizational contexts. In some organizations, norms and the power structure may be crystallized so that advanced information technology effects will appear to be deterministic; most groups will use the technology in a similar fashion and the interaction system will be regularized such that similar outcomes will ensue for all groups. At the other extreme there may be organizations which are so fluid that a wide variety of technology uses and impacts occur. In the middle range, there may be organizations that experience some variety in outcomes but enough commonality to detect patterns.

A second strength of AST is that it accounts for the structural potential of technology and at the same time focuses squarely on technology use as a key determinant of technology impacts. Technologies differ in the social structures they provide, and groups can adapt technologies in different ways, develop different attitudes toward them, and use them for different social purposes. AST expounds the nature of social structures within advanced information technologies and the key interaction processes that figure in their use. By captur-

ing these processes and tracing their impacts, we can reveal the complexity of technology-organization relationships. We can attain a better understanding of how to implement technologies, and we may also be able to develop improved designs or training programs that promote productive adaptations.

AST can also enhance our understanding of groups in general, not just those using technology. The major concepts of AST, as illustrated in Figure 1, cover the entire input → process → output sequence that McGrath and Altman (1966) and Hackman and Morris (1975) advocate as an organizing paradigm for group research. AST provides a general approach to the study of how groups organize themselves, a process that plays a crucial role in group outcomes and organizational change.

Several avenues of study are important at this point. First, the theory and measurement approaches laid out in this paper can be further developed. We presented major concepts for the study of technology-induced change and stated seven propositions regarding relationships among these concepts. Refinement of these concepts and articulation of specific research hypotheses is the next step. We outlined a general analytic strategy for applying AST and illustrated its application to the study of GDSSs in small group settings. Our research strategy could be specified in more detail and tested for its usefulness across a range of advanced information technologies and organizational contexts. Because GDSSs make structures particularly salient and manipulable, they are excellent test cases for research on group structuring behavior; but settings other than GDSS use by small groups must be examined if the power of AST is to be fully explored. AST assumes that although structural change lies below the surface of decision making, it can be captured in interpersonal interaction, at micro, global, and institutional levels. For each level we offered illustrative variables and measurement approaches. But specific variables and measurement will depend, of course, on the particular technology, context, and interaction processes of interest to the researcher. A critical challenge is to systematize the research so that technologies and interaction processes can be meaningfully assessed and comparative measurement is possible. To organize the interpretive process of studying structuration, we devised elaborate schemes (e.g., Table 5) and simpler schemes (e.g., Table 7) for categorizing appropriation and its sub-processes; we acknowledge that there is a tradeoff between comprehensiveness and parsimony, and simple schemes may do as well as elaborate schemes. Devel-

opment and debate about ways to codify the social structures of technology and action would appear to be a healthy agenda for researchers.

In addition to these theoretical and method issues, a second direction for research is to directly test the explanatory and predictive power of AST. AST posits that four major sources of structure (technology, task, environment, and the group's internal system) affect social interaction which, in turn, is the key determinant of social outcomes (such as decision efficiency, quality, consensus, etc.). Empirical tests of these relationships and of the evolution of new social structures are needed. Further, AST rests on assumptions that are similar (e.g., technology is socially constructed) and different from (e.g., appropriation is the critical process in social constructionism) other emergent models. Studies which clarify and empirically test the validity of assumptions that underlie emergent models in general, not just AST, would be especially helpful to our understanding of advanced information technologies and their use in organizations.

Finally, the link between technology-triggered changes at micro, global, and institutional levels can be studied. Individual studies tend to target one level of analysis, rather than multiple levels; and theoretical expositions tend to be unilevel as well. AST focuses on interpersonal interaction and so is amenable for study at multiple levels. Pursuit of methods to link study of interaction at, for example, the small group level, with interaction that occurs in organizational units, the organization at large, or even outside of the organization, will strengthen research on organizational change and the role of technology in change processes. Such analyses will serve to further link inquiry in information systems and organizational communication to the large and growing study of advanced information technologies.

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Endnotes

¹See Grief (1988), Jessup & Valacich (1993), and Pinsonneault & Kraemer (1989) for reviews of GDSS literature and analyses of conflicting findings.

²Several writers recently have called for the development of integrative theories and methods (Lee 1991; Orlikowski 1992).

³The term group is used in our discussion to refer to two or more people who interact with one another in the context of the advanced

information technology; dyads, small or large groups, departments, and organizations are included.

⁴In fact, we applied the same schemes to an additional 16 groups, with each of us (as researchers) categorizing the speech or other acts of all 18 meetings. The estimate of intercoder reliability for the categorizations, based on a sample of 225 codes and assessed with Cohen's Kappa, was 0.92 for structure source (Table 3) and 0.84 for the nine major categories of appropriation moves (Table 5). Raw percentage of agreement between two coders on appropriation moves ranged from 60% to 90%. The results of this more extensive analysis are given in Poole and DeSanctis (1992).

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