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Terri L. Griffith
Santa Clara University, tgriffith@scu.edu

Gregory B. Northcraft

Mark A. Fuller

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BORGS IN THE ORG? ORGANIZATIONAL DECISION MAKING AND TECHNOLOGY*

TERRI L. GRIFFITH
GREGORY B. NORTHCRAFT
MARK A. FULLER

Introduction

The Merriam-Webster Dictionary (Anon. 1974) defines technology as "a technical means for achieving a practical outcome." In common parlance, technology means tools, and humankind is a prodigious user of tools. In the decision-making arena, we might think of technology as any physical tool exogenous to human cognition

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to identify all possible alternatives for a choice scenario. Tversky and Kahneman later (e.g., 1974) built on this foundation by identifying a number of heuristics that individual decision makers use that bias their information gathering (e.g., availability: Wilson et al. 1985) or analysis (e.g., anchoring: Northcraft and Neale 1988) attempts. In light of the concept of bounded rationality, a reasonable question to ask is to what extent technology augments decision making, removing the limits on rationality suggested by the work of Simon, and that of Tversky and Kahneman?

The use of computers to augment individual decision making emerged in the mid-1970s (e.g., Keen and Scott Morton 1978). The formal concept of Decision Support Systems (DSS) was introduced by Gorry and Scott Morton (1971). Shim et al. (2002) identify four technology developments that have influenced decision support more recently:

- Data warehousing: The collection and storage of integrated data (e.g., transaction records from a bank or retail store).
- On-line analytical processing: the assessment of "warehoused" data by analysts or management using software for to help them see different views, reports, and the like.
- Data mining: a more sophisticated form of on-line analytical processing using statistical and artificial intelligence methods. The goal is to identify patterns and then develop rules of action. For example, analysts might discover that ice cream and bananas are often purchased at the same time and so should be shelved near one another in a grocery store.
- Web: the World Wide Web (www) (via the Internet) provides both a development and delivery platform for the use of technology in decision making. Shim et al. note that the www can make it both easier and less costly to make information and model-driven decision tools available around the world.

We discuss these four technological advancements in terms of their ability to support activities related to the two primary decision making activities of information gathering and information use.

Information Gathering

Data warehousing and the development of the World Wide Web both augment information gathering (search) processes in individual decision making by increasing the availability of required information. Imagine, for example, that one wanted to buy new golf clubs. Thirty years ago, the cost of information gathering would likely have limited an individual's search process to geographically proximal vendors and the golf clubs they stocked. Today, a prospective purchaser can log onto the World Wide Web to find out what types of golf clubs are available anywhere; consult databases, chat rooms, and bulletin boards (e.g., epinions.com) to gather product information and user opinions; and compare prices across vendors around the world.

Paradoxically, the technological augmentation of information availability for individual decision making might also eventually reduce the need for comprehensive information search. The possibility of making a poor decision (for example, overpaying for a product) is to some extent premised on the existence of inefficient markets. Consumers overpay only if they don't know they don't have to do so. The heightened availability of information offered by information technology developments probably reduces the information asymmetry typical of seller–buyer relationships (Akerloff 1970; Baron and Besanko 1987) and in doing so decreases the likelihood of uninformed consumers. Ultimately technology-mediated increases in information availability might drive markets to be more efficient (something that seems to have already occurred to some extent with on-line airfares), and thus (paradoxically) reduce the need for consumers to be informed. After all, if consumers are fully informed, attempts at opportunistic pricing will only cost a vendor sales. Anyone who regularly shops on the web knows that most markets certainly have not yet reached that point of efficiency—witness the variance in prices one can still find for the same golf clubs from different on-line vendors.

Part of the reason that technology advancements have not necessarily created completely efficient markets is the distinction between information availability and information *possession.* The fact that a piece of information is available does not mean any particular individual decision maker can find it. In the context of the web, the fact that an on-line vendor has the lowest price for a product doesn't mean an individual decision maker can find that vendor on the web. In fact, the more information that is available, the *less* likely it should be that any particular—critical—piece of information will be found during a search. This reality reflects the fact that storage and search are both enacted processes. In many instances, the creators of information must characterize that information in order to store it on sites that use indexed search engines, much as historically file folders in a file cabinet had to be labeled. Characterizations of information—the labels or descriptions attached by its creators—limit the ability of searchers to find that information, if the searchers are using different terminology. On the other side of the coin, information search is also limited by the searcher's characterization of the target of the search. "Googling" a product requires an individual decision maker to decide how to characterize the product, and a poor choice of characterization (e.g., inadequate search terms) can lead to a less than satisfactory search outcome. Thus, the decision to characterize information—either at the level of storage or search—is itself subject to "bounded rationality," thus bounding the augmentation of individual decision making by technology-increased information availability.

Information Use

The availability of more information raises the specter of having more information to analyze in order to reach an appropriate choice. The ideas of information overload and "paralysis of analysis" (Baumgartner 2005) reflect an abundance problem (Brody 1998; Horowitz 1999), whereby "lightning-quick online searches typically lead Web users into piles of documents that are, to be kind, of dubious reliability" (Brody 1998: 26). Thanks to technology, our ability to collect data far exceeds our ability to make sense of it (Horowitz 1999: 55). For example, a web search for "golf clubs" generates over 42 million "hits."

Information integration technologies (including on-line analytical processing and data mining) reflect the ability of technology advancements to assist individual decision makers in the use (integration and analysis) of information they have gathered. Integration technologies thereby go beyond information gathering and take part in the analysis and choice processes. For example, TiVo, iTunes, Netflix, Amazon, and eBay all use a database of past customer searches and purchases to identify additional products customers might like, thereby simplifying the customer's future information search process. Similarly, Walmart is a leader with their extensive inventory tracking and control systems (using a set of computer systems described by CNBC as second only to the United States Pentagon's, CNBC, 2004). Beyond just storing every purchase ever made and using a real-time tracking system that looks like NASA's mission control, Wal-Mart is taking the lead in RFID[2] and vendor integration:

> Much of the data collected during RFID reads [Walmart will track cases of inventory from stockroom to floor to when the case boxes go to the trash] will be passed on to Retail Link, Wal-Mart's Web-based software that lets the retailer's buyers and some 30,000 suppliers check inventory, sales, and more. The company is developing software for Retail Link that will leverage that data and trigger a business process—for example, creating a purchase order. (Sullivan 2004)

We distinguish between systems intended to technologically supplement human decision making and systems intended to supplant human decision making with computerized information systems. However, even in systems intended to supplant human decision making (e.g., expert systems), the systems themselves must be adaptable to changes in the environment or decision making needs (Beynon et al. 2002: 130). As Davenport and Harris point out (2005: 84), "even the most automated systems rely on experts and managers to create and maintain rules and monitor the results." Thus, to the extent that such systems employ algorithms that integrate available information to either recommend or make a decision, these algorithms are still designed by humans, and therefore also raise the bounded rationality concerns raised by Simon. Even expert systems that can learn are still limited by the information they have been programmed—by their human architects—to learn from.

Decision Types and the Effectiveness of DSS

Some decisions may be more amenable to technological automation than others. Researchers have focused on examining the match between the decision being made, and the technology being used to support that decision. Perhaps this approach is best exemplified by the literature on Task-Technology Fit (Goodhue and Thompson 1995; Zigurs and Buckland 1999). When a decision is routine—when the parameters of the decision and possible choice options are well known a priori—a decision is said to be well "structured" and thereby a good candidate for automation (Simon 1960).

Unfortunately for technology, not all decisions are so well structured, and not all decision environments allow even structured decisions to remain so for long. Yates et al. (2003) note that the use of systems to support decision making has been disappointing in some cases because the technology is not able to capture "quality dimensions" that are of importance to users. The ability of organizations to delegate routine decisions to DSS can alter the fundamental nature of work, by allowing decision makers to focus more of their attention on those decisions that are not amenable to automation (Chase et al. 1984). The benefits, however, depend on the joint structuring of the work, the technology, and the particular people involved (for example, their knowledge, skills, and abilities).

Arnold and Sutton (1998) suggest that DSS may be most useful in those circumstances where expert tacit knowledge is least accessible to novice decision makers, so that the DSS provides the maximum advantage over the decision maker's own intuitions or calculations. Unfortunately, this assumes that the DSS has faithfully captured the expert's tacit knowledge, and further raises concerns that a (novice) decision maker under those circumstances will be least able to understand whether current circumstances render the DSS recommended choice inappropriate, or perhaps even how to implement the DSS output (Rochlin 1997). Decision automation may also prove unfortunate for the novice in that DSS use may decrease learning (Brody et al. 2003) in much the same way that many parents now fear that overreliance on calculators or computers hinders the development of math skills or writing skills in their children.

Another problem suggested by the mixed results of DSS implementations is that technology may give rise to unwarranted confidence (Alpert and Raiffa 1982). Xia (citing Koriat et al. 1980; Sniezek et al. 1990) suggests that "research has shown that effort and extensiveness of information processing could increase choice confidence although not necessarily increase decision correctness" (Xia 1999: 271). The use of a DSS might create an "aura of objectivity" as a function of the unbiased information processing it represents. Inappropriate deferral to a DSS without critical consideration of its limitations may result—a problem complicated by the fact that such overconfidence may be more likely to occur when task expertise is low (Arnold et al. 1998). More generally, turning over control of decisions to technology begs the question of the extent to which decision making can faithfully adjust to the changes and challenges of a dynamic environment.

The bottom line is that while DSS can relax some of the limitations on individual decision making implied by Simon's concept of "bounded rationality," technologyassisted decision making falls far short of being "un-bounded" rationality, and is perhaps more accurately described as "less bounded" rationality. Not surprisingly, then, meta-analyses of DSS impacts by McLeod (1992) and Benbasat and Lim (1993) generally have shown equivocal results. In the end, decision aids (like DSS) necessarily reflect some of the limitations of their creators. Some bounds on individual rationality will always remain (such as the inherent limitations imposed by the very human process of information characterization), no matter how sophisticated the technology involved. When it comes to DSS, there is always a "ghost in the machine" (Ryle 1949) and woe to the decision maker who fails to bear that limitation in mind.

Beynon et al. (2002) propose that the impossibility of absolutely rational individual decision making suggests that the goal of DSS design ultimately should not be the supplanting of human decision makers, but instead to understand, "how can we substantially improve the quality of interaction, and the degree of flexible engagement, between humans and computers" (p. 127). In other words, how can we augment human decision making by supplementing and supplanting only where appropriate (Schwartz 2001)?

Group Decision Making

Changing the level of analysis from individual to group decisions raises a host of new issues in understanding an appropriate role for technology. Group decision support systems (GDSS), like DSS, are systems developed to augment human decision making, although within the specific context of groupwork. DeSanctis and Gallupe (1987: 589) defined a GDSS as a technology designed,

> to improve the process of group decision making by removing common communication barriers, providing techniques for structuring decision analysis, and systematically directing the pattern, timing, or content of discussion.

They further introduced a categorization scheme identifying levels of features, where level 1 systems facilitate information exchange through technical features, level 2 systems provide additional decision modeling and automated planning tools, and level 3 systems "are characterized by machine-induced group communication patterns and can include expert advice" (DeSanctis et al. 1987: 594).

Broader Group Support System (GSS) technologies focus on within group processes rather than individual impediments to effective decision making. For example, a key concern for group decision making is process loss. In the context of group decision making, process loss is the inability of a group to take advantage of all the information at its disposal to make a decision (e.g., Steiner 1972; Pinsonneault et al.

1999). For example, the inability of a group to access all of the information available among its members to make a decision invites the possibility of missing critical information, and thereby making a suboptimal decision. In addition to their effects on the core processes of information gathering and information use, GSS technologies also influence process loss via group configuration.

Group Configuration

Shim et al. (2002: 116) note that: "One of the more significant trends over the past 20 years has been the evolution from individual stand-alone computers to the highly interconnected telecommunications network environment of today." Griffith and Neale (2001) argue that technology broadens the possible pool of group members. In effect, the existence of GSS technologies has created new opportunities for interaction, so some decisions can now be group-based that previously might have needed to be individual-based.

In many respects, virtual groups have different dynamics than their face-to-face counterparts. Chidambaram (1996), for example, suggests that virtual groups tend to be more task oriented and exchange less social–emotional information, slowing the development of relational links (Chidambaram 1996). Others (e.g., Griffith et al. 2003) show virtual groups having greater procedural conflict (conflict about how the work will be done) than face-to-face groups, but similar goal focused or relationship focused conflict. There is also evidence that conflict goes undiscovered longer in more virtual groups (Chase 1999) and that such groups may communicate less effectively (Hightower and Sayeed 1995; Northcraft et al. 2006). Despite these drawbacks, many of which can be alleviated through training or facilitation, the use of groupware to allow geographically distributed participation in decision making increases the probability that a group will have access to critical information needed to make a high quality decision. The broad-based virtual participation in decisions allowed by GSS also promotes better understanding of decisions, and potentially more investment and ownership of those decisions during implementation.

Information Gathering

Regardless of configuration, a key, but difficult, first step in groups is to access all the information available in the group (e.g., Stasser and Titus 1985). One major feature of GSS design is the possibility of increasing the airtime available to individual group members by allowing everyone to electronically "talk" simultaneously, rather than having to wait and "take turns" (Pinsonneault et al. 1999; Potter and Balthazard 2004). Increased airtime increases the probability that everyone who has critical information will find an opportunity to surface it.

Increased opportunities for contribution don't necessarily translate into better information, however (Pinsonneault et al. 1999). For example, more airtime presents another version of the abundance problem noted earlier (Brody 1998). If everyone in a group can electronically talk at once, there will be more ideas to sort through to find the most decision-critical information.

Furthermore, social influence (Festinger 1954) is an ever-present force in group discussions. Social influence refers to the willingness of individuals to use others as a primary source of information about how they should be feeling or thinking (Asch 1956; Latane and Darley 1970). In group settings, social influence processes can convince an individual that critical information she or he possesses is in fact unimportant, or too disruptive to volunteer, leading that individual to not share that critical information with the group. In more virtual settings, co-located subgroups may be similarly hampered, with the subgroups not sharing information with their distant counterparts (Northcraft et al. 2006). Group decision making quality suffers accordingly.

On the other hand, technology can enhance a group's ability to surface particularly diverse and potentially disruptive information. For example, a GSS can be structured to collect ideas from participants electronically before anyone in the group knows what anyone else thinks, thus forestalling the possibility that conformity pressures will inhibit initial idea contributions. GSS can also render ongoing idea exchange during group discussions anonymous, thus increasing the willingness of participants to be controversially critical of ideas that have been surfaced. Significantly, these benefits are obviously available even to groups that do not use technological intermediation for their discussions (e.g., everyone could write down their ideas on paper and submit them anonymously). However, the increased psychological distance among group members created by technological intermediation—particularly when it enables anonymous contribution—may significantly lower conformity pressures in groups, thereby increasing the probability that unique critical information is shared in the group.

Perhaps one key to accessing all the information available in a group is understanding who knows what in the group. Transactive memory (Wegner 1986; Moreland 1999; Hollingshead 2001) refers to a group's understanding of the experience and expertise represented among its membership. Groups that have good transactive memory typically outperform groups that don't (e.g., Lewis 2004; Lewis et al. 2006) because they know where to seek out critical information among their members for high quality decision making. In effect, it is harder for process loss to occur if the group knows where (in which member) the critical information resides. (This can also provide a means for overcoming the abundance problem by prioritizing search around the comments of the most expert group members.) Although transactive memory is typically thought of as something in the heads of group participants (e.g., Hollingshead 2001), the idea of a technologically mediated transactive memory or $(TM)^2$ refers to a people-focused database (such as personal profiles of community of practice members) that captures physically (electronically) a representation of a group's transactive memory. In this vein, technology offers the possibility of creating an electronic expertise/experience directory that can be searched by the group, and is NOT reliant on particular group members' physical memory (though still reliant on human characterizations of particular individuals' experience and expertise). This sort of database can also assist groups at the composition level, by increasing understanding of who needs to be participating in order to maximize the probability that critical information sources will be represented among the discussion participants.

Information Use

GSS provide opportunities for information processing that differ from those available in face-to-face environments. These differences are tied to the features (Griffith and Northcraft 1994) that the GSS provides, such as parallelism (the ability to allow decision-making participants to exchange, and thus start to use, information at the same time), group memory (the recording and ability to recall information shared related to decision making), and anonymity (the ability to exchange and use information without knowing the source of the information). Each of these features can potentially influence information use by groups.

Some researchers argue that GSS features such as group memory may reduce the cognitive blocking associated with decision making. Cognitive blocking occurs when current information can't be processed concurrently with the assimilation of new information and vice versa (Lamm and Trommsdorff 1973). The group memory features of a GSS—where past information shared can be retrieved for current information use—may help decision-making groups by-pass this cognitive blocking, and thus enhance group decision making.

Similarly, features like anonymity may also help groups make better decisions (e.g., Baltes et al. 2002). Normative influence effects may, for example, cause opinions in the minority to be suppressed, even if those opinions are correct. Public commitment to a position reduces the likelihood that group members will change their positions downstream. From an information influence standpoint, creating an environment where minority opinions persist may stimulate additional information processing. These sorts of normative and information influences may be affected by features such as anonymity embedded in GSS.

Research has shown that GSS may not always demonstrate these desired benefits on information use (Dennis 1996; Baltes et al. 2002). Dennis posits four possible reasons for the limited effects we observe when using information in GSS environments. First, given that GSS have the technical ability to enhance the information gathering and exchange process (discussed earlier), perhaps the additional information provided in a GSS environment may distract from higher quality information use. Second, GSS come in a variety of flavors and configurations. While this flexibility may be useful under the control of expert users or facilitators, in average settings the GSS may not be appropriately configured to the task—basically an issue of task-technology fit (Zigurs et al. 1999; Dennis et al. 2001). Third, features like anonymity may have a very different effect on decision making than anticipated. Information provided anonymously may lack credibility and accountability; thus, even if a GSS facilitates the provision of more information, the information may be of lower perceived quality. Further, anonymity may also reduce the ability to clarify or challenge information provided by a contributor. Fourth and finally, a GSS may make it harder to identify important information, given that more information is exchanged, and the social cues that may be tied to "important" information in a face-to-face interaction may be missing in technology mediated environments. In essence, information may get lost in the shuffle if not appropriately managed through proactive facilitation, training, or some other method that lets the group adapt their methods and tools.

This is not to say that such systems are without hope. Software is now available that allows groups to model their decision making (Chen et al. 2002). Such technologies may allow us to quickly identify the strengths and weakness of strategies (through the use of stakeholder analysis tools), or to quickly assess group attitudes towards particular decision options (for example, through voting tools and multicriteria analysis tools). Furthermore, new research on capturing decision makers' mental models—using GSS—may provide decision makers with new opportunities for learning through conceptualization, discussion, and experimentation, which in turn may support a group's integration of knowledge (Kivijarvi and Tuominen 2001). Perhaps more importantly, we will get better at how to adaptively structure (DeSanctis and Poole 1994) the combined strengths of the technology, the people, and the process.

Implications in a Rapidly Evolving World

Reminiscent of an old children's math riddle: if each succeeding generation of technology decreases the remaining bounds on rational decision making by 50 percent, how soon will decision making be completely rational? Answer: Never—technology can continually improve decision making but never can it completely overcome the cognitive limits of its architects.

Our review paints a picture of uncertainty regarding the interactions between technology and decision making. As noted by Weick (1990), there is a technology in the head—the one that matters—that is related to, but generally not the same as, the one on the floor. People *enact* technologies, based on human sensemaking, which renders the moderating role of technology in decision making dynamic.[3] The enactment of technology is particularly critical in groups since it is unlikely that group members will homogeneously enact the same technology (e.g., Griffith 1999). In the early years of Doug Engelbart's career, individuals were more likely to know when they were interacting with technology. The adjustments people made as they used technological tools were often concrete and so likely to trigger sensemaking and adaptive structuration (Griffith 1999).

Today's landscape is quite different. The best knowledge management systems, for example, are largely passive (Griffith and Sawyer 2006). Systems such as that provided by Tacit (www.tacit.com) are designed to work in the background without human intervention, until someone needs to find an answer or someone who can provide an answer. Sensemaking about these more passive (from the human perspective) technologies may be more varied given there are less concrete features on which to base sensemaking and ultimately, adaptive structuration.

We are moving from technology playing a signal role in decision making to a pervasive one. Hansmann et al. (2003) outline these pervasive/ubiquitous computing principles:

- Decentralization—synchronized computing, everywhere.
- Diversification—possession and use of several specialized devices (for example, a laptop computer, a mobile phone, and an iPod (p. 19).
- Connectivity—Lou Gerstner of IBM described his version of connectivity as "Everybody's software, running on everybody's hardware, over everybody's network" (pp. 19–20).
- Simplicity—seamless integration across these devices. "Complex technology is hidden behind a friendly user-interface" (p. 22).

This future computing landscape is a necessary, but not sufficient, condition for what we call Pervasive Decision Support (PDS). PDS additionally implies that individuals and groups are engrained with a predilection to take on new capabilities. We aren't arguing for "Borgs in the org" with a deterministic refrain of "you will be assimilated,"[4] but rather an extension of human skill sets to include methods of adaptive structuration—decisions about how to integrate with technology for the most efficient and effective decision making in a given context.

Users aren't there yet. Jasperson et al. (2005) recently took on the task of modeling the "post-adoptive" behaviors of IT users. They found that IT users apply a limited set of technology features and "rarely initiate technology or task-related extensions of the available features" (p. 526) if left to their own devices.

It will take continued development of organizational practices and technological tools to fully reap the benefits of technology for organizational decision making. Jasperson et al. (2005) argue for a research stream to address how to motivate users to "[continuously] exploit and extend the functionality built into IT applications" (p. 525). It seems critical to help users understand that availability and implementation of technology is just the beginning of effective use.

An explicit approach is needed for:

1. Teaching users to be flexible with their adaptive structuration. Users need to understand that how they are working today may not be the way they should work tomorrow given ever increasing capabilities—and they should embrace the opportunity for these adjustments. The PDS landscape is in constant flux and so users need to be able to make explicit choices about adapting their decision-making approach. What new capabilities should be incorporated? What new capabilities are not worth the transaction cost? Expectations, technology features, and implementation approaches all may affect the likelihood that people are willing to evolve their use of technology systems. Expectations that adjustments in use are likely may prevent users from "anchoring" (Tversky et al. 1974) on the initial form of use. Technology features such as SIM cards and transferable phone numbers in cell phones reduce some switching costs. Implementation built around simulation and/or virtual reality (e.g., Ottosson 2002) may also provide avenues for users to discern better combinations of technology and decision practice before settling into a particular pattern of use.
2. Grasping the organizational realities. Decision-making functions in an organizational context. Currently this means that a camera-capable smartphone may be taken away at the front desk of a firm concerned about data leakage (or a health club); the National Science Foundation may scan a PC for viruses before it can be brought inside their offices; a wireless-enabled laptop may be cut off from the Internet at a vendor's site given security protocols. These organizational realities need to be factored into the decision-making approach. For example, decision makers need to make appropriate choices about what information to carry on a hard drive, versus what can be accessed via an Internet-based source; plans must be made for conference calls with an understanding of the network's capabilities (e.g., number of calls that can be connected via one phone).
3. Presenting systems integration as a life skill—at least until the fully integrated view of pervasive computing (Hansmann et al. 2003) is a reality. For modern decision makers to take full advantage of the current level of PDS, they need to realize that there are integration costs. While Apple markets its Mac personal computer based on a model of full integration (for example, limited effort needed on the part of the user to integrate digital cameras and photo-editing capabilities), that is not the reality of IT today. Users need a basic level of literacy around the integration of various information sources. At a minimum level this means understanding that electronic data can be moved from application to application, though it may not be obvious. For example, www.melissadata.com/ssl/HomeSales.asp provides data on home sales by zip code. This information

can be useful for tracking trends in a local real estate market, if the information can be moved into an application such as Excel. It would be nice if there were a "download" button on the website, but there is not. The minimum skill of being able to cut and paste the data from the screen, into an application which can put it into a column and row structure, is key to getting the most out of available data.[5]

4. Setting boundaries about where to stop with the integration of technology and decision making. This last point again highlights the difference between technologies that supplement versus supplant human activities in decision making. Decision-support systems vary in their design for supplementing versus supplanting, as well as in their form of use (either supplementing or supplanting). If PDS supplements decision making, there is the opportunity to learn from the experience; the decision maker is still involved in the process and receives feedback about the inputs, processes, and outcomes. If there is tacit information that the system doesn't know, the decision maker can adjust. If the environment changes, the decision maker can adjust. If the PDS *supplants* human decision-making activity the decision maker loses out on the opportunity to make real-time adjustments and to learn from the cause and effect of the process. A decision has been made, but the decision maker may have no idea about the decision's quality. This then begs the question of the form that monitoring and control of the supplanting PDS should take.

These last four points highlight the parameters for effectively enacting technologically augmented decision making. Ancient technologies and even early computer-based decision tools were more likely to trigger the thoughtful consideration necessary to get the most from the technology while maintaining control of the process. Technologies were more physical and/or obtrusive. Now the biggest questions may be how to effectively and mindfully incorporate technology in decision making and what to do in the situations where technology is not available, where decision makers have to effectively revert to less enabled approaches.

Endnotes

1 Doug Englebart is the inventor of the mouse, hypertext, and a winner of the National Medal of Technology in 2000.

2 RFID: radio frequency identification. Minimally, RFID is a wireless/radio-based barcode (for more, see www.rfidjournal.com/article/gettingstarted/).

3 Organizational and management information systems scholars have built a solid foundation in this area. For examples, please see Carlson and Zmud (1999), DeSanctis and Poole (1994), Griffith (1999) and, Orlikowski (1992).

4 See for example: Episode #75, *Star Trek: The Next Generation*, "The Best of Both Worlds, Part II."

5 The speed of technology change was brought home to us by a recent Wall Street Journal article (Mossberg and Boehret 2006). In between the first and second drafts of this chapter, Zillow.com was reviewed. Zillow.com provides a satellite image-enabled database of housing prices by zip code, street, or street corner—a dramatic increase in the ease of information gathering.

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