December 2006

Sensemaking in a Distributed Environment

David Paul
University of Denver

Sensemaking in a Distributed Environment

David L. Paul
Daniels College of Business
University of Denver
dapaul@du.edu

ABSTRACT

As globalization continues to increase, sensemaking in a distributed environment is likely to grow in importance as the expertise necessary to address increasing environmental complexity is more widely geographically dispersed. Paradoxically, the information and communication technologies that make sensemaking in a distributed environment possible simultaneously may create a context that inhibits the effectiveness of such efforts. The purpose of this research is to develop a better understanding of how sensemaking in a distributed environment can be effectively and efficiently carried out. Case studies of four teleconsultation projects involving virtual teams engaged in healthcare delivery are presented. This paper make a contribution in that it deals with critical problems that practitioners must address and it integrates research relating to wicked decision problems, virtual teams, and the role of IT in health care.

Keywords

Sensemaking, virtual teams, telemedicine, knowledge management.

INTRODUCTION

With the rise of virtual teams, sensemaking is increasingly being performed in a distributed environment. Sensemaking is a means of equivocality reduction that enables organizations to effectively and efficiently address environmental complexity. The quality of sensemaking activities is sensitive to the absorptive capacity of the participating actors, where combining people with different, relevant expertise and experiences in a reciprocally interdependent process can result in a multiplicative increase in a team's sensemaking capabilities (Griffith, Sawyer, and Neale, 2003). Rich, complex virtual work such as sensemaking in a distributed environment is now possible on a regular basis as a result of advances information and communication technologies (ICTs). ICTs can potentially create ever deeper and broader knowledge networks (Alavi and Leidner, 2001), and by substituting technology for collocation, a distributed environment has the major attraction of readily increasing the breadth and depth of experiences, expertise and knowledge available. As globalization continues to increase, sensemaking in a distributed environment—like other emergent, knowledge-based social processes—is going to grow in importance as the expertise necessary to address increasing environmental complexity is becoming more geographically dispersed (Te'eni, 2001).

Paradoxically, the information and communication technologies that make sensemaking and knowledge-based activities in a distributed environment possible simultaneously may create a context that inhibits the effectiveness of such efforts. Actors in distributed environments are more likely to be drawn from different social networks that may have different norms, roles, and routines. Virtual environments change social interaction and communication patterns, creating what are in effect brand new environments qualitatively different from the collocated environments in which the actors are used to operating (Te'eni, 2001). These differences create changes that may negatively impact the effectiveness of sensemaking in a distributed environment by significantly impacting sensemaking properties. Thus, the technology that makes it possible to almost instantaneously assemble virtual teams that have access to potentially greater sensemaking resources than do collocated teams simultaneously may create conditions that bars effectively utilizing those resources.

The purpose of this research is to develop a better understanding of how sensemaking in a distributed environment can be effectively and efficiently carried out. Sensemaking has seven properties, and changes in these properties can impact the effectiveness of sensemaking activities and the triggers for such activities (Weick, 1985, 1995). Drawing on a study of four teleconsultation projects involving virtual teams engaged in healthcare delivery, this research analyzes the context in which effective sensemaking activities in a distributed environment occur and how such activities can be supported. It identifies the potential barriers resulting from a distributed environment and how those barriers can be addressed.

The phenomenon of sensemaking in a distributed environment is in its early phases and it seems likely to be of interest because of its relevance and integrative nature of three important, but quite different, trends. First, companies are faced with

increasingly wicked (Mason and Mitroff, 1973) or messy (Ackoff, 1999) problems that are less structured or unstructurable in nature (Calton and Payne, 2003). Second, companies are increasingly relying on virtual teams to attempt to effectively and efficiently address such difficult problems. Third, the application of IT in healthcare is a mess in that "the inability, and reluctance, of doctors and hospitals to use information technology more widely is killing thousands of people" (The Economist, April 30, 2005, p. 65).

CHALLENGES TO SENSEMAKING IN A DISTRIBUTED ENVIRONMENT

Sensemaking is a multifaceted, emergent, knowledge-based creative social process of communicative action that is highly contextualized and is cognitively, affectively, and dynamically complex. It occurs when two or more actors establish interpersonal relationships in an effort to reach an understanding about the relevant situation—especially those involving novel, poorly analyzable tasks—to reach agreement and coordinate their plans of action. Like other emergent, knowledge based activities, it is communicatively complex and has difficult information and action requirements (Te'eni, 2001).

However, as exhibited in Table 1, a distributed environment presents major challenges to each of the seven key properties of sensemaking. First, sensemaking is focused on and by extracting salient cues (Weick, 1979, 1995, 1999). Sensemaking is sensitive to the context in which it occurs, yet a distributed environment's modes of presentation can be very different from a collocated environment. Technology changes representations, and slight changes in the cues noticed and their interpretation may significantly impact the effectiveness of sensemaking activities (Weick, 1979, 1995, 1999). This may result in the effectiveness of sensemaking activities in a distributed environment being materially different from face-to-face sensemaking activities (Orton and Weick, 1990; Weick, 1985, 1995).

Sensemaking Property	Distributed Environment Challenges
1. Extracting & Focusing on Salient Cues	• Modes of Presentation Change • Cues Noticed or Extracted Change
2. Enabling Retrospect	• Speed and Complexity of ICTs Does Not Facilitate Necessary Reflection and Deliberation
3. Facilitating Necessary Social Processes	• Social Dynamics Change • Sensemakers Drawn from Different Social Networks May Have Different Social Norms
4. Enacting Sensible Environments	• Challenges to Communicating Emotions and Tacit Knowledge
5. Constructing/ Maintaining Personal Identity	• Changes in Interaction/Communication Processes • Roles of Individuals May Change
6. Determining Plausibility	• Challenges to Communicating Emotions and Storytelling • Sensemakers Drawn from Different Social Networks May Have Different Norms and Standards
7. Ongoing Process	• Continuous Nature of ICTs May Change What and How Occasions for Sensemaking Are Triggered

Table 1. Challenges to Sensemaking in a Distributed Environment

Second, sensemaking is retrospective and high in cognitive complexity. Retrospect requires reflection and deliberation, where sensemakers attempt to make sense of the situation at hand by drawing on their experiences, expertise, cognitive models, scripts, and emotions from the past and develop or enact sensible environments (Weick, 1993, 1995, 1999). In a distributed environment, the large and growing disparity between information technology's speed and complexity and the ability of humans to comprehend its outputs (Orton et al., 1990; Weick, 1995) in even more pronounced, especially in light of the fact that human capacity for attention has remained more or less constant (Davenport, 1999). This disparity hinders retrospection (Orton et al., 1990; Weick, 1985, 1995). Third, sensemaking is a social process that is sensitive to the social context in which it exists, and the social dynamics of sensemaking in a distributed environment may be different from those of a face-to-face environment and sensemakers in a distributed environment may be drawn from different networks which may have different, conflicting social norms (Weick, 1979, 1985, 1999).

Fourth, sensemakers must enact (or create) a sensible environment under conditions where there are multiple plausible but equivocal meanings and environments. Enacting sensible environments has both a rational and emotional component, making emotion, feelings, thoughts, and biases as important as information and hard data (Weick, 1995, 1999). Sensemaking requires

a rich context, yet shared understandings are difficult to develop and transferring the tacit knowledge and emotions involved in enactment are difficult in a distributed environment. Tacit knowledge is often communicated through the emotions and information contained in naturalistic or narrative mode such as stories and metaphors. Information technologies are driven by decision rationality, and sensemakers cannot engage in effective sensemaking if they approach it from a detached, passive, and purely rational perspective (Orton et al., 1990; Weick, 1985, 1995).

Fifth, sensemaking is grounded in the construction and maintenance of the sensemakers' individual identities (Weick, 1995, 1999). Personal identity is the sense of who one is in a particular setting (Weick, 1999) and it facilitates the creation of intersubjective sensemaking, where two or more individuals' thoughts, feelings, and intentions are merged or synthesized into meaning of the situation at hand (Weick, 1993, 1995). The lack of diversity of individuals' identities limits intersubjective sensemaking capabilities and replaces them with generic subjective sensemaking capabilities that are insufficient when novel situations are faced (Weick, 1995; Wiley, 1988). Further, personal identities are more likely to be destroyed than supported in a distributed environment (Orton et al., 1990; Weick, 1995). Identities are constituted out of the process of interaction (Weick, 1995, 1999), yet technology changes the interaction process and may result in much of the richness or intimacy of interpersonal interaction being lost. It may also change the roles which the agents are used to filling. Sensemakers may project different and less coherent identities in distributed environments than when they are face-to-face. A more generic subjective sense of the world may be created as a result, increasing the vulnerability of sensemakers to sudden, complex changes (Prasad, 1993; Weick, 1995).

Sixth, sensemaking is driven by plausibility and involves the telling of a good story. Accuracy may inhibit developing a good story and enacting sensible environments. However, a distributed environment presents many challenges in assessing plausibility (Weick, 1995, 1999). ICTs facilitate the transfer of decision rationality. It is more difficult to communicate the emotions, nonverbal cues, and the narrative rationality that is involved in the telling of a good story. Further, agents from different social networks may have very different norms and standards as to what is considered plausible.

Seventh, sensemaking is an ongoing process, but the continuous, stochastic, and abstract nature of technology (Griffith, 1999; Orton et al., 1990) may change what and how occasions for sensemaking are triggered. There are many possible triggers in IT-enabled sensemaking (Griffith, 1999), and IT may impact who and how events are defined. Sensemakers in a distributed environment may find that the speed and complexity at which IT provides additional information makes it more difficult for them to bound ongoing events and keep pace with them. A distributed environment may thrust sensemakers into the different roles than which they may be comfortable filling, and they may be unable to continuously update their activities and enact environments as rapidly as required by the technology (Orton et al., 1990; Weick, 1985, 1995).

The potential barriers to effective sensemaking in a distributed environment have been identified by examining how each of the seven properties of sensemaking can be impacted by the characteristics of a distributed environment. After a summary of the methodology, how these barriers were overcome or addressed in order to facilitate effective sensemaking in a distributed environment are presented.

METHODOLOGY

This research was grounded in the intensive study of multiple cases, relying on issue-focused semi-structured interviews of key informants as the primary means of data collection.[i] Multiple case studies enhanced validity and generalizability and provided the thick description needed to develop a deeper understanding of sensemaking in a distributed environment in order to better understand and explain it (Benbasat, Goldstein, and Mead, 1987; Eisenhardt, 1989; Orlikowski, 1993; Yin, 1994). Grounded theory methodology enabled theory to be generated and tested by collecting and inductively analyzing the data through constant comparisons within and across cases (Glaser and Strauss, 1967; Martin and Turner, 1986; Strauss and Corbin, 1990).

Case Description

Four teleconsultation projects at three different sites were studied. Health care delivery is often a sensemaking activity, where health care providers are required to make sense of multiple and often contradictory symptoms resulting from the complexity of human anatomy and psychology, where each individual presents health care providers with unique problems due to comorbidity of conditions, differences in age, variations in genetic factors, and variations in environmental factors, in order to make a diagnosis and prescribe a treatment regimen (Eddy, 1984, 1990; Eddy and Billing, 1988; Silberman, 1992). Telemedicine, "the use of electronic information and communications technologies to provide and support health care when distance separates the participants" (Institute of Medicine (IOM), 1996, p. 2), is a form of virtual collaboration (Paul, Pearlson, and McDaniel, 2000) where two or more geographically separated health care providers work together via information technology to provide value added health care delivery. Teleconsultations generally involve one health care

provider—usually a primary care provider seeking advice from a specialist or sub-specialist—who has specialized expertise regarding the health problem at hand. Teleconsultations thus involve sensemaking in a distributed environment.

Each involved a relationship between a health sciences center (HSC) and a rural health care facility. Projects involving HSCs were selected because they represent the majority of civilian telemedicine projects (IOM, 1996; Office of Rural Health Policy, 1997), and they did not have many of the legal, cultural, financial, and other non-technological barriers associated with some teleconsultations (Paul, Pearlson, and McDaniel, 1999). Each teleconsultation project involved virtual, autonomous teams where participation and membership was voluntary. To allow technological and procedural bugs to be addressed and the novelty of teleconsultations to pass, each of the projects chosen had been operational for a minimum of four months. Site I was the only site where two different teleconsultation projects were located. One project involved pediatric oncology while the other involved infectious diseases. Table 2 provides a summary of each site.

	SITE I		**SITE II**	**SITE III**
Clinical Application	Pediatric Oncology	Infectious Diseases	Bone Marrow Transplant—Oncology	Multiple Specialties
Clinical Activity	Monitoring of Pediatric Leukemia Patients	Diagnosis, Treatment, and Monitoring of Multiple Drug Resistant Infectious Diseases Patients	Initial Consultation To Determine Patient Physical and Psychological Suitability For Bone Marrow Transplant Procedure and Patient Monitoring As Needed	Diagnosis, Treatment, and Monitoring of Multiple Patient Conditions Including Surgery, Pediatrics, Neonatology, Dermatology, and Nephrology
Project Status	*Discontinued*	Ongoing	Ongoing	Ongoing
System Utilization	One Time/Week	Multiple Times/Wk	One Time/Week	One to Two Times/Week
HSC Participants	Pediatric Oncologists	Infectious Diseases Specialist, Others	Oncologists	Primary Care Physicians (One With Surgical Training)
Remote Site Participants	Registered Nurses	Primary Care Physicians	Oncology Sub-Specialists, Nurses, Case Coordinator	Multiple Specialists and Sub-Specialists
Site Location	Southwestern United States		Western United States	Southwestern United States
HSC Affiliation	HSC I		HSC II	HSC III
Distance To HSC	200 Miles		300 Miles	400 Miles (200 To Nearest HSC)
HSC Equipment Location	Teleconsultation Studio	Studio (Later Desktop Unit)	Administrative Area	Teleconsultation Studio
Telecom Link	Full T1		Full T1	Full T1
Remote Facility	Hospital		Physicians' Clinic	Hospital
Remote Equip. Location	Administrative Conference Room		Administrative Area (Was In Reception Area)	Administrative Conference Room
Remote Facility Teleconsultation Equipment	Videoconference Equipment. Includes Xenon Light Source and Attachments, Electronic Microscope and Stethoscope		Videoconference Equipment	Videoconference Equipment. Includes Xenon Light Source and Attachments.

Table 2. Site Information

Data Collection and Analysis

Fifty-two health care professionals were interviewed, and the interviews were audiotaped and transcribed. Semi-structured interviews of key informants provided thick and richly textured data (Eisenhardt, 1989; Martin et al., 1986; Orlikowski, 1993), and focused on the actual usage of the teleconsultation equipment. Key informants were selected based on their current or past direct involvement in their organization's teleconsultation projects and their availability, and were members of

one of three groups—health care providers (physicians, physician assistants, or nurse practitioners), administrators, and information technology professionals.

Examples of teleconsultations engaging in sensemaking in a distributed environment were first identified. The data were then analyzed and reanalyzed and common patterns across the research sites were found. The sensemaking and IS literature was utilized to help in understanding the findings. This process involved the constant revisiting of the data and the research literature. What emerged out of this iterative process was a grounded theory of how information technology impacts the seven key properties of sensemaking, and how these impacts were or were not accounted and adjusted for. The next section presents the findings of this study.

RESULTS

Addressing the Challenges of Sensemaking in a Distributed Environment

This section presents the potential challenges facing each of the seven key properties of sensemaking in a distributed environment and how these issues were or were not addressed and accounted for. A precondition for sensemaking in a distributed environment to be effective and valued is that the need for additional sensemaking capabilities must exist. This condition held in the teleconsultation projects studied. Wicked decision problems were not a new phenomenon to remotely located health care providers; however, prior to the advent of teleconsultations, economic or technology barriers limited remote care providers' sensemaking capabilities to their own abilities or the abilities of other primary care providers in the community. Patients' economic status often prevented their traveling to an HSC to seek specialty care, and there were limitations on the effectiveness of communicating with specialists by telephone or facsimile. Despite the remotely located providers' best intentions, these limitations on sensemaking capabilities negatively impacted the quality of patient care. A remotely located primary care physician involved in the multiple specialties teleconsultation project described the situation.

> Question: How were some of these cases handled prior to telemedicine?
>
> We just took a wild-ass guess. We did, because a lot of these folks can't get up there (to the HSC). You know, you can try calling, but it's not the same thing as looking at it, and so a lot of it was just... You just used your best judgment and went on.

The advantages of sensemaking in a distributed environment are the increased breadth and depth of knowledge, expertise, and experiences made available. Teleconsultations accomplished this by connecting remote health care providers with HSC specialists and sub-specialists. The increase in the breadth of expertise made available was illustrated in the infectious diseases teleconsultation project, where a rural physician put together a group of doctors who had different types of expertise relative to the infectious diseases problem. The depth of expertise was also increase by bringing together different groups infectious diseases specialists who had different treatment regimens. The rural physician noted that she would not have taken this challenge on without the teleconsultation project.

1. Extracting and Focusing on Salient Cues

The findings indicated the effectiveness of sensemaking projects in a distributed environment was sensitive to the types of cues required. Not surprisingly, sensemaking projects in a distributed environment were perceived as being effective when visual cues were important. However, not all types of visual cues were useful. Complex visual cues that could not be transmitted by other means were especially useful in sensemaking projects in a distributed environment. A remote physician involved with the multiple specialties teleconsultation project explained.

> If you're just giving data and the guy can comment on the data about a patient, then it's really not that necessary, but when … you try to describe a skin lesion—you can say maculopapular until you're blue in the face, but people don't really know what you're trying to say. But when you show them pictures, that says it all.

Teleconsultation projects that engaged primarily in information processing were likely to be discontinued if other, simpler means of information transfer such as telephone or facsimile were available. A pediatric oncologist described how they initially engaged in teleconsultations, but gradually realized they were using the system for information transfer and that the cues they needed could be conveyed just as well by other means. He believed they were getting good information, but not additional information from the teleconsultations that could not be done "with a fax and a telephone". In this case, the teleconsultation sessions were utilized for information processing and not sensemaking, and the teleconsultation project was terminated.

Cue extraction was sensitive to the environmental conditions in which sensemaking occurred, and information technology sometimes changed such conditions dramatically. Changes in cues noticed is not necessarily bad; however, the health care

providers were used to face-to-face sensemaking processes that had a successful track record; therefore, efforts were made to minimize changes in the cues noticed and extracted. The teleconsultation projects minimized the effect of information technology on cue extraction by designing the sessions to avoid distractions and to be similar to the traditional face-to-face consultations (sensemaking sessions) with which the physicians were familiar. Engaging in the consultations virtually was a significant change from how physicians had traditionally consulted with each other, and all the projects made an effort to make the teleconsultation (or sensemaking) process similar to the collocated process. The sessions were therefore organized to minimize distractions to the sensemaking activities, and the differences between sensemaking in distributed and collocated environments were further minimized by designing and deploying the teleconsultation equipment in a manner that did not interfere with the sensemaking process.

2. Enabling Retrospect

By designing the sessions and implementing the technology in a manner to avoid distractions and be similar to traditional face-to-face consultations, the teleconsultation projects not only supported cue extraction but also facilitated reflection and deliberation. Another strategy utilized to address the disparity between IT's speed and complexity and the sensemaker's ability to reflect and deliberate was to reduce the need for reflection and deliberation by turning wicked decision problems into structured decision problems. The use of teleconsultation sessions in emergencies was an example. Emergencies tend to be wicked and messy in that the history of the individual involved most likely is not known, nor may all relevant medical conditions be known. The exact injury may not be known, and the more serious the injury, the more likely the patient is unable to communicate essential information. Further, the nature of emergencies is such that time is of the essence. Teleconsultations were not utilized much for sensemaking in a distributed environment in emergencies because the decision was made to turn the wicked decision problems of an emergency into a structured decision problem. The decision the remote care providers had to make was whether to treat the patient locally or transport them to the nearest HSC. To make that decision, the remote health care provider had to answer two questions: First, are the facilities available locally to provide the type of treatment necessary? Second, is the expertise and experience available locally to provide the necessary treatment? If the answer to either of these two questions was no, then the decision was the patient needed to be transported. This structuring of a wicked problem was highly effective in that the HSC involved with the multiple specialties teleconsultation project experienced approximately two emergencies per year which were in the gray area about whether or not they should be handled over the teleconsultation system.

3. Facilitating Necessary Social Processes

Sensemaking is a social process. It was therefore critical for effective sensemaking in teleconsultations that the remote health care providers were treated with respect, especially in cases where there were significant professional status differentials between the high status HSC sub-specialists and specialists and the low status rural primary care providers. Being treated with respect was particularly important for establishing interpersonal trust between the sensemakers. An administrator/physician at the infectious diseases remote site commented that physicians tend to rely on those they trust when assistance is needed, and teleconsultations were useful in determining the other party's trustworthiness.

Further, it was critical that the specialists and sub-specialists trusted the expertise of the remote care providers involved in the teleconsultation projects. While there may have been physicians at the HSCs who had concerns about the abilities of rural physicians, they were generally not involved in the teleconsultations. A consistent finding was the specialists and sub-specialists involved in the teleconsultation projects respected the abilities of care providers at the remote site. One oncologist even described himself as being a "partner" with HSC II's sub-specialists in the treatment of the remote site's patients. The pediatric oncology teleconsultation project was the only project studied where the HSC specialists expressed doubts about the expertise of the remote site's care providers and this was also the only project studied which was discontinued. While there were a number of reasons for the project's demise, the pediatric oncologists not trusting the remote site's nurses' expertise was a major contributor. A pediatric oncologist at HSC I explained.

> I think overall, we thought we could do a really good job with (the telemedicine equipment). The only—the only problem there was was with the operator (nurse) on the other end.

4. Enacting Sensible Environments

Enacting sensible environments has both a rational and emotional component, making emotion, feelings, thoughts, and biases as important as information and hard data. A patient trying to communicate an illness in effect is trying to enact an environment by communicating a story that the specialists could make sense of. The Director of the Bone Marrow Transplant

unit at HSC II described the most important part of the initial consultation with the prospective transplant patient, which could be effectively performed via teleconsultations, as follows.

> The critical part was the connection, the discussion with the patient, looking them in the eye, getting the pieces of information that you could not quite get off the paper.

Sensemaking is high in affective complexity and the teleconsultation sessions enabled the very personal and emotional communication between the patients at remote sites and specialists at HSCs. A pediatric oncologist gave an example of his making an emotional connection with a patient's family, which resulted in the patient's mothering crying. Such interpersonal connections were facilitated by designing the sessions and implementing the technology in a manner to avoid distractions and be similar to traditional face-to-face consultations. The benefits of this were discussed in the cues and retrospect sections.

5. Constructing and Maintaining Personal Identity

A distributed environment may be more likely to destroy personal identity than to develop and support it. Telemedicine projects are often perceived by the remote care providers as an initial step by the HSCs to replace them and thus threaten their livelihood (IOM, 1996). A means to address this concern was to position the teleconsultation projects as being complementary to instead of a potential substitute for remote care providers' practices. For example, the remote site's oncologists in the bone marrow transplant teleconsultation project initially felt threatened by the project, but these concerns dissipated once the sessions started. They believed participating in the teleconsultation sessions enhanced their competence in that it enabled them to gain tacit knowledge not available in the literature.

A particularly effective means by which to enhance and support the identity construction and maintenance of the parties is to include an educational component in the sensemaking activities. The educational component of the teleconsultation sessions provided remote care providers with the personal and professional growth necessary and reinforced the identity and role of the remote care providers by providing reassurance and support for them.

However, personal identity construction and maintenance in a distributed environment was constrained by the absorptive capacity of the other sensemaking parties. Like collocated sensemaking, each party in sensemaking in a distributed environment had to have at least a minimal level of relevant expertise and experiences in order for the personal identity of the others to be maintained and enhanced. For example, in both the pediatric oncology and the bone marrow transplant teleconsultation projects, specialists at the HSCs relied on the expertise of the remote care providers to act as their sense of touch in performing physical examinations. In the case of the bone marrow transplant teleconsultation project, this was not a problem because the remotely located oncologists could substitute for the sense of touch and provide the information the bone marrow transplant specialists needed. However, the lack of requisite expertise on the part of the nurses at the remote site was a major reason why the pediatric oncology teleconsultation project was discontinued. The pediatric oncologists relied on the nurses to possess a certain level of expertise to generate the needed cues that could not be effectively transmitted via the teleconsultation equipment. The lack of such expertise significantly inhibited the pediatric oncologists' sensemaking capabilities. In this case, the nurses lacked the training (requisite level of expertise) to perform such an exam adequately.

6. Determining Plausibility

The teleconsultation technology utilized in a distributed environment had to support plausibility, although there was a belief by the designers (and some users) that the technology had to support accuracy. Designers were influenced by an information processing perspective of decision making in that they assumed the users required more information of increased precision to address the uncertainty faced. However, the users were actually engaged in sensemaking, and rather than provide them with more precise information on which to base a decision, the technology instead had to be good enough for the users to confirm or deny their hunches. Sensemaking in a distributed environment thus involved the users testing the plausibility (and less the accuracy) of their beliefs. As a result, the technology capabilities actually necessary were less than those initially thought as being required.

In the case of teleconsultations, this meant that the health care professional were using the teleconsultation sessions more to support the plausibility of their diagnosis and less to make a definitive diagnosis. All the teleconsultation sessions studied were utilizing radiographic images in their teleconsultations, even though the images transmitted did not meet American College of Radiology standards. The physicians involved still found the quality of the transmitted images more than sufficient for their sensemaking needs. The Director of the Bone Marrow Transplant Unit at HSC II used the equipment to evaluate CT-scans, while a pediatric oncologist at HSC I utilized the transmitted images to confirm the presence of a tumor in one of their patients. Image quality was sufficient for the health care providers' needs despite the resolution not meeting professional body standards because the providers were not utilizing the radiographic images to make definitive diagnosis;

rather they were utilizing them to judge the plausibility of their suspicions or beliefs. Therefore, the quality of the radiographic images had to be sufficient to support or call into question their interpretation of the situation at hand.

7. Ongoing Process

Sensemaking is an ongoing process, but the continuous nature of ICTs presents major challenges to identifying occasions for sensemaking in a distributed environment. The findings indicated that the party with the decision-making responsibility defined the occasions for sensemaking. In the teleconsultations, it was the remote care providers who triggered such occasions by setting boundaries and defining which events needed additional sensemaking capabilities. The remote care providers had the decision-making responsibilities because they were legally responsible for patient care. They initiated sensemaking sessions when they believed their own expertise and experience were not sufficient for the health care problem at hand.

The educational component of the sensemaking sessions in a distributed environment had a meaningful benefit in addition to reinforcing sensemaker identity in that it enabled individual decision-makers to address on their own wicked decision problems that previously had required teleconsultations. A remote physician participating in the multiple specialties teleconsultation project felt that the learning effect taking place during teleconsultation sessions enabled remote care providers to address a greater variety of their patients' health care problems on their own, enabling remote care providers to address health care problems locally they previously would have had to transport to the HSCs. The Director of Telemedicine at HSC III believed the remote sites could now handle 30% more of the cases locally as a result.

The learning effect enabled remote care providers to address more of the problems themselves, in effect raising the bar for triggering of sensemaking occasions. The situation remote care providers faced had to be of even greater complexity than previously faced in order to trigger an occasion for sensemaking. Health care problems of greater complexity that previously had been transported to the HSCs were now being treated locally via teleconsultations. This increased the number of sessions held but dropped the number of patients transferred to the HSCs.

DISCUSSION

The phenomenon of sensemaking—and other emergent, knowledge-based social processes—in a distributed environment is in its early phases and seems likely to be an area of paramount importance to organizations as they face increasingly wicked or messy problems and as globalization means that the needed resources are often geographically dispersed over wide areas. This paper has made a contribution in that it has demonstrated that effective and efficient sensemaking in a distributed environment is possible. The major challenges to sensemaking in a distributed environment and how such challenges can be addressed and accounted for have been identified and discussed.

This research has a number of implications. To facilitate sensemaking in a distributed environment, attention must be paid to both the design of the technology and the design of the sensemaking sessions themselves in order to minimize the distractions to the sensemaking process. This can help sensemakers identify the relevant cues and enable them to engage in the required reflection and deliberation. Attention must be paid to the parties involved in sensemaking projects in a distributed environment and the social context in which these projects occur. Sensemakers in a distributed environment are more likely to be drawn from different social networks that have different norms of behavior and standards of inquiry. It is essential that a supportive social context involving trust and respect of the other parties be created and supported. Simultaneously, the absorptive capacity of the individuals involved must be taken into account. Sensemaking is a knowledge-based activity, and the cognitive capabilities of all the sensemaking parties must be such that the necessary learning can take place.

The educational component of the sensemaking sessions must not be overlooked. The educational component not only serves to reinforce the personal identity of the sensemakers involved, but it increases the complexity of decision problems the remote sensemakers are better able to handle by themselves. This learning effect means that successful sensemaking projects may engage in fewer and fewer sensemaking sessions over time; however, the sensemaking sessions held are likely to address even more complex problems than previously considered possible to address in a distributed environment. Therefore, measuring the success of sensemaking projects in a distributed environment by the number of sessions held may be inappropriate and misleading.

At the same time, this research has identified additional questions that future research needs to address. Future research needs to delve deeper into each of the seven properties of sensemaking and the challenges to them in a distributed environment. Future research needs to take a holistic perspective of sensemaking and other knowledge-based emergent processes in a distributed environment and attempt to identify and better understand the multiple interdependencies and interactions likely involved, and how the positive interactions can be supported and enhanced, and the more problematic interactions be

addressed and their effects minimized. It is probable that such interdependencies and interactions have not only first order effects, but important second and third order effects that impact the quality of sensemaking in a distributed environment. Future research needs to address and better understand the complexities of sensemaking in a distributed environment.

REFERENCES

1. Ackoff, R. (1999). Recreating the corporation: A design for the 21st century. New York, Oxford University Press.
2. Alavi, M., and Leidner, D. (2001). Review: knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 25, 1, 107-148.
3. Benbasat, I., Goldstein, D., and Mead, M. (1987). The case research strategy in studies of information systems. *MIS Quarterly*, 11, 3, 369-386.
4. Calton, J., and Payne, S. (2003). Coping with paradox: Multistakeholder learning dialogue as a pluralist sensemaking process for addressing messy problems. *Business and Society*, 42, *1*, 71-92.
5. Eddy, D. (1984). Variation in physician practice: The role of uncertainty. *Health Affairs*, 3, 2, 74-89.
6. Eddy, D. (1990). Clinical decision making: From theory to practice. *Journal of the American Medical Association*, 273, 4, 287-290.
7. Eddy, D., and Billing, J. (1988). The quality of medical evidence: Implications for quality of care. *Health Affairs*, 7, 1, 19-32.
8. Eisenhardt, K. (1989). Building theories from case study research. *Academy of Management Review*, 14, 3, 532-550.
9. Glaser, B., and Strauss, A. (1967). The discovery of grounded theory: Strategies for qualitative research. New York, Aldine Publishing Company.
10. Griffith, T. (1999). Technology features as triggers for sensemaking. *Academy of Management Review*, 24, 3, 472.
11. Griffith, T., and Neale, M. (2001). Information processing in traditional, hybrid, and virtual teams: From nascent knowledge to transactive memory. *Research in Organizational Behavior*, 23, 3, 379.
12. Griffith, T., Sawyer, J., and Neale, M. (2003). Virtualness and knowledge in teams: Managing the love triangle of organizations, individuals, and information technology. *MIS Quarterly*, 27, 2, 265.
13. Institute of Medicine. (1996). Telemedicine: A guide to assessing telecommunications in health care. Washington, D.C., National Academy Press.
14. Markus, M., Majchrzak, A., and Gasser, L. (2002). A design theory for systems that support emergent knowledge processes. *MIS Quarterly*, 26, 3, 179.
15. Martin, P., and Turner, B. (1986). Grounded theory and organizational research. *Journal of Applied Behavioral Science*, 22, 2, 141-157.
16. Mason, R., and Mitroff, I. (1973). A program for research on management information systems. *Management Science*, 19, 5, 475-487.
17. Office of Rural Health Policy. (1997). *Exploratory Evaluation of Rural Applications of Telemedicine*. Rockville, MD, United States Department of Health and Human Services.
18. Orlikowski, W. (1993). CASE tools as organizational change: Investigating incremental and radical changes in systems development. *MIS Quarterly*, 17, 3, 309-340.
19. Paul, D. (2006). Collaborative activities in virtual settings: A knowledge management perspective of telemedicine. *Journal of Management Information Systems*, 22, 4, 143-176.
20. Paul, D., Pearlson, K., and McDaniel, R. (1999). Technological barriers to telemedicine: Technology management implications. *IEEE Transactions on Engineering Management*, 6, 2, 279-288.
21. Paul, D., Pearlson, K., and McDaniel, R. (2000). Telemedicine: A virtual collaboration perspective. *International Journal of Technology Management*, 7, 1/2/3/4, 37-55.
22. Prasad, P. (1993). Symbolic processes in the implementation of technological change: A symbolic interactionist study of work computerization. *Academy of Management Journal*, 36, 1, 1400-1429.
23. Silberman, C. (1992). What is it like to be a patient in the 1990s?, in Institute of Medicine (Ed.), Technology and health care in an era of limits, Washington, D.C., National Academy Press, 165-197.

24. Strauss, A., and Corbin, J. (1998). Basics of qualitative research: Grounded theory procedures and techniques (2nd Ed.). Newbury Park, CA, Sage.
25. Te'eni, D. (2001). Review: A cognitive-affective model of organizational communication for designing it. *MIS Quarterly*, 25, 2, 251.
26. The Economist. (2005, April 30). IT in the health-care industry. *The Economist*, 375, 15, 65-67.
27. Weick, K. (1979). The social psychology of organizing. New York, McGraw-Hill.
28. Weick, K. (1985). Cosmos vs. chaos: Sense and nonsense in electronic contexts. *Organizational Dynamics*, 14, 2, 51-64.
29. Weick, K. (1993a). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly*, 38, 3, 628-652.
30. Weick, K. (1993b). Sensemaking in organizations: Small structures with large consequences, in J. Murnigham (Ed.), *Social psychology in organizations: Advances in theory and research*. Englewood Cliffs, NJ, Prentice-Hall, 10-37.
31. Weick, K. (1995). Sensemaking in organizations. Thousand Oaks, CA, Sage.
32. Weick, K. (1999). Sensemaking as an organizational dimension of global change, in J. Dutton and Cooperrider (Eds.), *The human dimensions of global change*. Thousand Oaks, CA, Sage, 35-57.
33. Wiley, N. (1988). The micro-macro problem in social theory. *Sociological Theory*, 6, 2, 254-261.
34. Yin, R. (1994). Case study research: Design and methods (2nd Ed.). Thousand Oaks, CA, Sage.

---

[i] See Paul (2006) for a more thorough discussion of the research methodology.